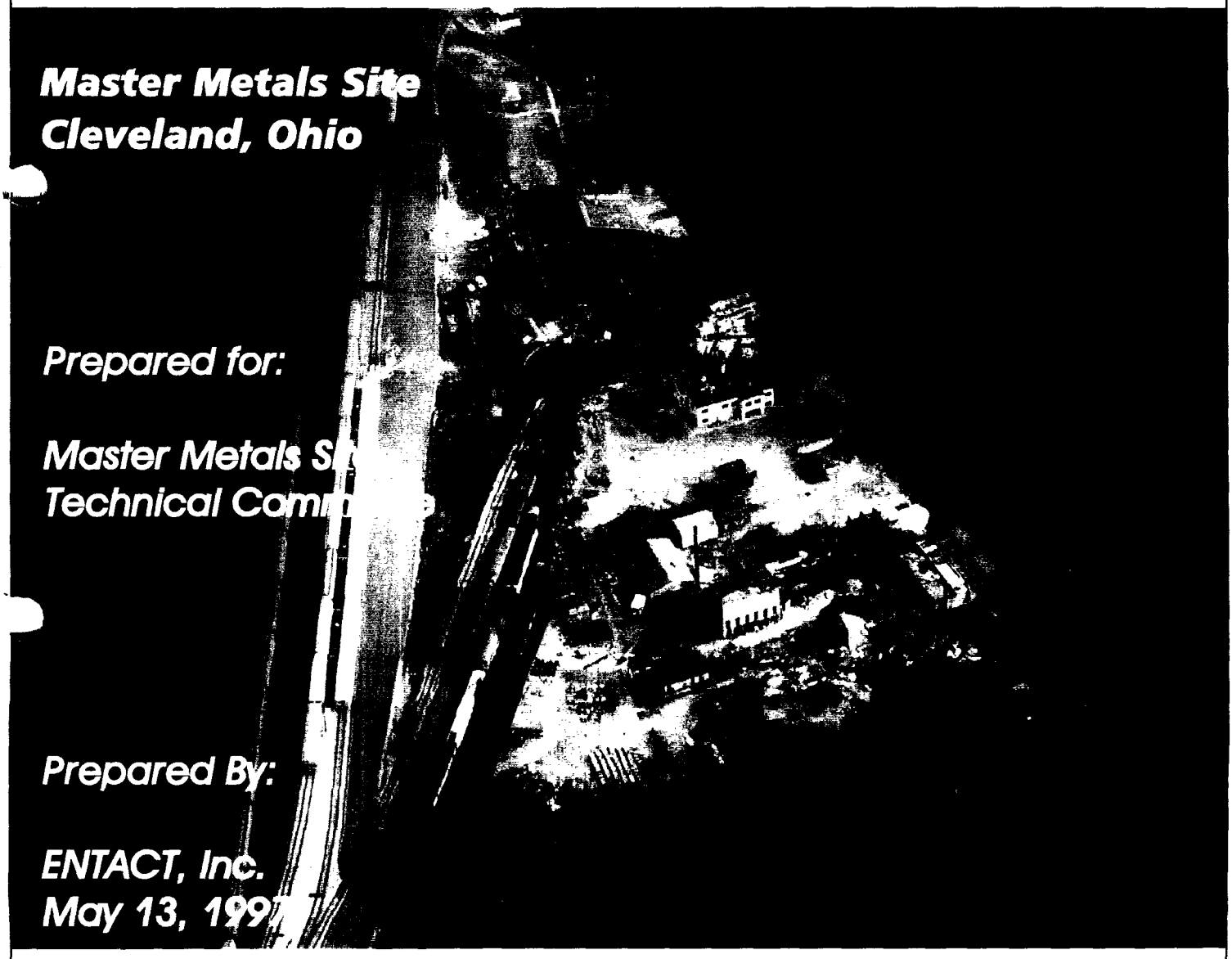
PHASE I TIME-CRITICAL

REMOVAL ACTION WORKPLAN

BOOK 2 - APPENDICES B & C



Master Metals Site
Cleveland, Ohio

Prepared for:

Master Metals Si
Technical Comm

Prepared By:

ENTACT, Inc.
May 13, 199

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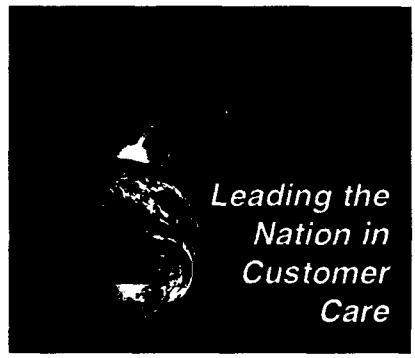

Prepared for:

Master Metals Site
Technical Committee

Prepared By:

ENTACT, Inc.
May 13, 1997

1360 North Wood Dale Road Suite A Wood Dale, Illinois 60191 Phone (630) 616-2100

PHASE I TIME-CRITICAL REMOVAL ACTION WORKPLAN

for the

MASTER METALS SITE

Cleveland, Ohio

May 13, 1997

ENTACT

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QUALITY ASSURANCE PROJECT PLAN
TO THE
PHASE I TIME-CRITICAL WORKPLAN

for the:

MASTER METALS SITE

Cleveland, Ohio

Prepared by:

ENTACT, Inc.

May 13, 1997

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1.0 PROJECT DESCRIPTION

1.1 Introduction

This Phase I Quality Assurance Project Plan (QAPP), has been developed for the Master Metals Site for use in conjunction with the Phase I Time-Critical Removal Workplan and Health and Safety Plan. These documents form the project operation plans intended to guide field personnel, contractors, and other involved parties in all aspects of field operations during Phase I. This QAPP will provide quality assurance (QA) and quality control (QC) procedures for activities to be performed in accordance with the Administrative Order (Order) for the Master Metals Site issued pursuant to Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended 42 U.S.C.§9606(a).

This QAPP will serve as a controlling mechanism during the performance of the sampling and analysis activities to ensure that technical data gathered are accurate, precise, complete, and representative of actual field conditions and meet minimum requirements of the project.

1.1.1 Overall Phase I Project Objectives

Overall project objectives for Phase I are fully described in the Workplan and are summarized below:

- Analysis and mapping of waste materials for removal purposes;
- Excavation, consolidation, demolition, and removal of highly contaminated buildings;
- Removal of drums, barrels, and other bulk containers;
- Develop and implement a site health and safety plan; and
- Provide and maintain site security and warnings.

1.1.2 QAPP Preparation and Guidelines

All QA and QC procedures described in this QAPP are structured in accordance with

applicable technical standards, EPA requirements, regulations, and guidance. The guidance manual entitled, "Region 5 Model RCRA Quality Assurance Project Plan", May, 1993 was specifically used during QAPP document preparation. Quality assurance (QA) is a management system for ensuring that all information, data, and decisions resulting from the removal action are technically sound and properly documented. Quality control (QC) is the functional mechanism through which quality assurance achieves its goals. In the event there is a conflict in specifications presented herein with those presented in the parent document referencing this QAPP, then the specifications in the parent document will be followed to the extent they are different.

1.2 Site Description

1.2.1 Site Location and Description

The Master Metals Site is located at 2850 West Third Street, Cleveland, Cuyahoga County, Ohio. The site consists of two contiguous parcels totaling approximately 4.3 acres. The property is roughly right triangle-shaped with the southeast corner being the 90 degree angle. The site is bounded on the northwest by railyards owned by the Baltimore and Ohio railroad, on the south by a dead end road, and on the east by West Third Street. The site is enclosed by a ten foot chain link fence. The site is in a heavily industrialized area. LTV Steel owns the property to the north and south of the site.

The Cuyahoga River is approximately 0.5 miles east of the site and flows northward to empty into Lake Erie. Site topographic maps suggest that the direction of groundwater and surface water flow at the facility is northeast toward the Cuyahoga River. The water table is at a depth of about ten feet below the ground surface. Surface soil consists of natural soil developed on either glacial till or river alluvium, and fill material. The fill consists mainly of cinders and slag.

The major features of the site include an office building, numerous storage areas, two baghouses, and a deteriorating smelter building.

1.3 Site/Facility History

1.3.1 General History

Master Metals was a secondary lead smelting facility that produced lead alloys from lead-bearing dross, spent industrial batteries and various other lead scrap materials. In addition, Master Metals recycled flue dust and captured baghouse emissions from its furnace operation. The plant was constructed as a secondary lead smelter in 1932 and was purchased by Master Metals from National Lead in 1979.

ON November 19, 1980, Master Metals obtained interim status to operate certain of the facility's waste piles and treatment units, and a containerized storage area. On November 8, 1985, the hazardous waste piles that contained lead bearing dust (D008 and K069) at the facility lost interim status for failure to certify compliance with financial requirements of 40 CFR 265. The U.S. Department of Justice filed a complaint for violations of RCRA on June 15, 1987 seeking closure of the waste piles and compliance with financial responsibility requirements.

During 1989, the Ohio EPA issued an order that cited Master Metals for emitting smoke from one of its furnaces that exceeded the regulatory limit of 10% opacity and for emitting excessive fugitive dust from both furnaces. The Order required the facility to implement new controls to reduce its emission of particulates and lead. On March 27, 1990, OEPA conducted a hazardous waste inspection and identified seven violations. Thirty-one violations were identified when the OEPA conducted a waste inspection on August 16, 1991.

On August 3, 1992, Ohio EPA ordered an immediate 30 day shut down of the facility because of violations of air quality standards for lead. On August 5, 1993, the OEPA director ordered Master metals to cease operating the facility until it could demonstrate compliance with air quality standards. These air quality violations were due to lead-laden

facility dust migrating off the facility via prevailing winds.

1.3.2 Past and Current Data Collection Activities

In December 1990, Master Metals contracted with Compliance Technologies to install and sample groundwater monitoring wells on the Master Metals site. Analytical results from the four monitoring wells indicated that the surrounding groundwater was contaminated at levels greater than the maximum contaminant levels for lead and cadmium established under the Safe Drinking Water Act.

Analysis of facility soil samples for total metals and pH revealed that the facility soils contained elevated levels of barium, cadmium, chromium, lead, and nickel. The southern portion of the facility near the drum storage area contained concentrations of lead exceeding 10,000 ppm. Elevated lead levels were also discovered near the battery cracking area.

In August 1991, Ohio EPA collected samples of raw materials from the rotary furnace and two waste bins as part of Consent Decree requirements. These samples contained lead concentrations as high as 5,349 mg/L.

In July 1992, U.S. EPA collected through contractor soil samples on and around the facility property to determine if the facility contaminants were subject to airborne transport. Analysis of these samples for RCRA metals and TCLP metals revealed that TCLP lead was present in concentrations more than 200 times the regulatory level of 5 mg/L at all sample locations except for one facility and one off-facility location. Facility soil samples indicate the presence of TCLP arsenic and cadmium, with one location testing at 115,000 ppm for lead. Surface samples collected from off facility locations indicated lead concentrations from 148 to 1,850 ppm.

1.4 Specific Project Objectives

1.4.1 Objectives and DQOs

The overall project objectives for the Phase I action are summarized in Section 1.1.1. Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during project activities and are based on the end uses of the data to be collected. As such, different data uses require different levels of data quality.

DQOs provide a clear definition of the objectives and the method by which decisions will be made. DQOs are developed using the following three-stage process:

Stage 1 - Identify decision types

Stage 2 - Identify data uses and needs

Stage 3 - Design data collection program

The structure of this QAPP and Workplan have complied with the intent of the DQO process. For Stage 1, the decision types have included identification of primary data users, including the Remedial Project Manager, Mr. Thomas Alcamo; the members of the Technical Steering Committee; and ENTACT, Inc. A review was performed of existing site data from the Site Assessment report by Ecology & Environment, dated August 1992 as well as Master Metals own contractor-derived analytical results. The overall purpose of the Phase I Workplan is to perform time-critical decontamination and removal activities.

In addition, some soil investigation work will be performed for the EE/CA evaluation determine the extent of soil lead impacts at each area and determine appropriate actions levels. To accomplish this objective, this Phase I Workplan includes the collection of soil samples, analysis of the soil samples for total lead by XRF and laboratory testing.

The DQO Stage 2 includes the identification of data uses and needs. Data generated during Phase I will be used to evaluate the exposed soil lead concentrations which may pose a risk to human health. This type of data is primarily soil data The data quality needs include the appropriate analytical levels and detection limit requirements. Analytical Level 2 will include using the XRF, as well as analysis of the soil characteristics (slag, silt, sand, etc.). Detection limits in the parts per million range are acceptable for Analytical Level 2 given a soil matrix and the expected ranges of solutions.

Soil samples will be taken and analyzed in the laboratory for total lead using Analytical Level 4 requirements. Detection limits in the low parts per million range are acceptable given the soil matrix and expected ranges of solutions. Samples will be analyzed for the parameters and detection limits listed on Table 3-1 of the Phase I Workplan. Analytical detection limits and other quality assurance objectives are presented on Table 3-1 of the Phase I Workplan.

Field duplicates and rinsate blanks will be taken for field quality assurance (QA) and quality control (QC), as well as laboratory QA and QC to be performed for all samples submitted to the laboratory.

Stage 3 of the DQOs focuses on the data collection program. The data collection program is described in the Workplan and includes use of field logbooks, XRF electronic database, and laboratory analysis reports.

Documentation of the laboratory quality control and conformance with the SW-846 analytical methods will be required for removal and XRF investigation activities. Field duplicates of the laboratory samples will be required at a rate of one (1) duplicate sample for each 10 analytical samples. An equipment rinsate blank will be submitted for every day of sampling.

1.4.2 Target Parameters and Intended Data Usages

The target parameters and test methods for Phase I are presented on Table 3-1 and 3-2 of the Phase I Workplan. Intended data usages include evaluating extent of lead(and possibly arsenic and cadmium) impacts to soil as well as characterization of on-site materials.

1.4.3 Field Parameters

The intended field parameters include soil sampling for total lead as analyzed by a field portable X-ray Fluorescence Analyzer (XRF).

1.4.4 Laboratory Parameters

The intended laboratory parameters for Phase I are presented on Table 3-1 of the Phase I Workplan. The parameters include the total lead for the evaluation of soil samples as well as characterization of on-site materials. Because the drummed materials are unknowns which could be aqueous or organic wastes or products, the exact definitive laboratory parameters cannot be presented. However, all laboratory procedures will be in accordance with approved EPA or ASTM derived methods and all methods performed will characterize the site materials for disposal or reuse.

1.4.5 Data Quality Objectives

The intended data quality objectives (DQOs) for this Phase I time-critical removal action are summarized on Table 3-1 and 3-2 of the Phase I Workplan.

1.5 Sampling Design and Rationale

The sampling rationale, fully explained in Section 3.0 of the Phase I time-critical Workplan is summarized below.

1.5.1 Sampling by Task and Matrix

Sample matrices, analytical parameters and frequencies of sample collection are presented on Table 3-3 of the Phase I Workplan.

1.5.2 Site Maps of Sampling Locations

A map showing the intended soil sampling locations is presented in the Phase I Workplan as Figure 3-1. It is possible, however, that depending on the nature of encountered field conditions some of these locations will be changed. The person who shall be responsible for making such decisions will be the Project Manager or the Quality Assurance Officer, whose responsibilities are described in Section 2.0 of this QAPP.

1.5.3 Rationale of Selected Sample Locations

The rationale for selected sampling locations is fully described in Section 3.0 of the Phase I Workplan.

1.6 Project Schedule

The project schedule is discussed in Section 6.0 of the Phase I Workplan. The project schedule is an approximation of time required to complete Phase I activities.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

ENTACT, Inc. (ENTACT) has overall responsibility for the Phase I removal action at the Master Metals Site. ENTACT will perform the work described in the Phase I Workplan and prepare the Phase I report. The various quality assurance, field, laboratory, and management responsibilities of key personnel are defined below.

2.1 Project Organization

The lines of authority for this specific project and a project organization chart are described in Section 6.0 of the Phase I Workplan. The project organization individuals are discussed below:

2.2 Management Responsibilities

- U.S. EPA Remedial Project Manager (RPM)

The U.S. EPA RPM, Mr. Thomas Alcamo, has overall responsibility for all phases of the removal action. Mr. Alcamo can be contacted as follows:

Mr. Thomas Alcamo
U.S. EPA Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, IL 60604-3590

- Project Management Team

Robert Santoro, Mike Stoub, Mike DeRosa, Shane Banks, and Dean Pisani will be the project management team in charge of the work and final completion of the project. They are responsible for ensuring that all project procedures and workmanship conform to regulatory guidelines and accepted engineering practices. All work under this management must be scheduled to allow QA and QC testing personnel to perform their duties. The project management team will delegate and oversee site safety protocol and coordinate emergency responsibilities. Additionally the project management team will be responsible

for maintaining the project schedule or amending as required. All site construction personnel report to the project management. ENTACT reserves the right to change the designated project management team. The Project Managers can be contacted as follows:

Project Management Team
ENTACT
1360 North Wood Dale, Suite A
Wood Dale, Illinois 60191
(630) 616-2100

- Quality Assurance Officer

Mr. Shane Banks will be the QA officer and will manage a planned system of inspections and testing procedures to directly monitor and control the quality of the project. All tests and inspections will be completed by him, or someone appointed by him, or outside testing services or analytical laboratories. The QA Officer is responsible for ensuring that all sampling and analysis performed pursuant to this project conforms to the EPA direction, approval, and guidance regarding sampling, quality assurance/ quality control, data validation, and chain of custody procedures. He will also ensure that the laboratory used to perform the analysis participates in a QA/QC program that complies with EPA guidance. All daily activities reports, periodic summaries, measurements and other pertinent activities will be scheduled and managed by him and all information will be reported to the Project Manager.

2.3 Laboratory Responsibilities

- Analytical Laboratory and Laboratory Project Manager

The laboratory to be used for all site sample analyses is National Environmental Testing laboratories (NET) , Bartlett, Illinois. The project manager for overseeing all sample results at the laboratory is Ms Mary Pearson. She will report to the ENTACT Project Manager or the ENTACT QA Officer All laboratory analysis will be performed by qualified laboratory

technicians under the supervision of Ms. Pearson.

All air analyses will be sent to Metropolitan Environmental Testing Services (METS) laboratory, Waldorf, Maryland. The project manager responsible for overseeing all sample results at the laboratory will be Ms. Karen Allison.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. The primary goal of the program is to ensure that the data generated meet the project requirements. To obtain this goal, data generated during implementation of the removal action will be evaluated for accuracy, precision, representativeness, completeness, and comparability for both the laboratory analytical program and field sample collection activities. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventative maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1 Precision

3.1.1 Definition

Precision is a measure of mutual agreement among individual measurements of the same matrix sample type. Precision is assessed through the calculation of relative percent differences (RPD) for duplicate samples. The equations to be used for precision in this Phase I removal action can be found in Section 12.0 of this QAPP.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples. The total number of duplicate samples is difficult to estimate since it is, in part, dependent upon the actual number of samples submitted for laboratory analysis.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed by analysis of matrix duplicates or matrix spike duplicates for each batch not to exceed 20 samples.

3.2 Accuracy

3.2.1 Definition

Accuracy is the degree of agreement between a measurement and an accepted reference or true value.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of equipment rinsate blanks, XRF reference standards, and adherence to all sample handling, preservation, and holding times.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or standard reference materials (SRM) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 12.0 of this QAPP.

3.3 Completeness

3.3.1 Definition

Completeness is the amount of valid data obtained from a measurement system compared to the amount that was expected and needed to be obtained to meet the project data goals.

3.3.2 Field Accuracy Objectives

Field completeness is the measurement of the amount of valid measurements obtained from all the measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent completeness. Realizing that under normal conditions this goal may not be achievable, the completeness goal for this program is 90 percent. The equation for completeness is presented in Section 12.0 of this QAPP.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent completeness. Realizing that under normal conditions this goal may not be achievable, the completeness goal for this program is 95 percent. The laboratory equation for completeness is presented in Section 12 of this QAPP.

3.4 Representativeness

3.4.1 Definition

Representativeness expresses the degree to which sample data accurately and precisely represent environmental conditions and parameter variations at a sampling location. The Representativeness criterion is best satisfied by assuring that sampling locations are properly selected and a sufficient number of investigative samples are collected.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan is followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of facility conditions. During the development of this network, consideration was given to past operational practices, existing analytical data, physical setting and environmental conditions. The rationale of the sampling network is discussed in detail in Section 3.0 of the Phase I time-critical Workplan.

3.5 Comparability

3.5.1 Definition

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions.

3.5.2 Measures to Ensure Comparability of Field Data

The use of documented and consistent soil sampling procedures will ensure the resulting data are comparable with other similar measurements on similar samples. The XRF calibration procedures described in Section 3.0 of the Workplan ensure consistent, site-specific results.

3.5.3 Measures to Ensure Comparability of Laboratory Data

The use of documented standard laboratory procedures will ensure comparability of results. Similar QA objectives will be used throughout the project to ensure comparability of laboratory generated data.

3.6 Level of Quality Control Effort

Field equipment blanks, duplicates, and standard reference materials will be utilized to assess the quality of data resulting from the field sampling and analytical programs.

3.6.1 Field Equipment Blanks

Field equipment blanks consisting of distilled water used to rinse decontaminated soil sampling equipment will be submitted to the analytical laboratory at a rate of 1 equipment blank per every ten (10) environmental samples.

3.6.2 Field Duplicates

Field duplicates will be collected and submitted to the laboratory at a rate of 1 duplicate per every 10 environmental samples.

3.6.3 Standard Reference Materials

Laboratory-prepared reference standards are used in the field to standardize XRF equipment on a daily basis.

3.6.4 Laboratory Quality Control

Method blanks, matrix spike duplicate samples, calibration blanks, continuing calibration verification, check standards and surrogates will be performed to assess the quality of laboratory data, where appropriate to the method and/or instrument, in accordance with the approved analytical method.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. All reagents are added to the blank in the same volumes or proportions as used in sample processing and is carried through the complete sample preparation and analytical procedure. Method blanks will be performed at a rate of 1 per sample batch not to exceed 20 samples.

Matrix spike samples provide information about the effect of the sample matrix on the digestion and measurement methodology. The sample is spiked with a known concentration of target analyte prior to preparation and analysis.

Further, matrix spike samples will be prepared in duplicate to check for analytical precision of a method within the matrix. One set of matrix spike duplicates will be analyzed for every batch of 20 or fewer investigative samples per sample matrix. Instrument calibration checks will be performed in accordance with the approved analytical method.

4.0 SAMPLE PROCEDURES

Sampling procedures for each sample type are fully described in Section 3.0 of the Phase I Workplan, including sampling methodology, equipment lists, sample identification, decontamination and sample packaging procedures. Section 3.0 of the Phase I Workplan is the Sampling and Analysis Plan (SAP).

The sampling procedures to be used in this Phase I removal action will be consistent throughout the duration of this project. The SAP outlines all sampling procedure information, including the following information:

- Sample Identification System - Section 3.3
- Establishment of Systematic Grid Coordinate System - Section 3.4
- Sampling Procedures - Section 3.5
- Detection Limit Requirements - Section 3.10.2
- Data Quality Objectives - Section 3.10
- Chain of Custody Control - Section 3.10.3
- Sample Shipping - Section 3.11
- Field Instrument Procedures, Operation, and Calibration - Section 3.12

5.0 SAMPLE CUSTODY AND SHIPPING PROCEDURES

5.1 Custody Procedures

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all original laboratory reports, are maintained under document control in a secure area.

A sample or evidence file is under your custody if:

- the item is in actual possession of a person; or
- the item is in the view of the person after being in actual possession of the person; or
- the item was in actual physical possession but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

5.1.1 Field Custody Procedures

Sample identification documents will be carefully prepared to maintain identification and chain-of-custody records and to control sample disposition. Components of the field documentation procedures include the use of field logbooks, sample labels, and the chain-of-custody forms. Original data recorded in field logbooks, chain-of-custody records, and other forms will be written in waterproof ink. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched.

5.1.1.1 Field Logbook Records

A field log of daily activities will be used to record sampling activities on a daily basis. This book will be bound and have consecutively numbered pages. Entries in the field logbook will be made in ink and will include: the name of the author; date and time of entry; location

of activity; names and affiliations of personnel on site; sample collection or measurement methods; number of samples collected; daily weather report; sample identification numbers; field observation and comments; sampling depth increment for soils; field measurements; locations of photographs; and any deviations from the sampling plan. The field log book will be stored in the document control center when it is not in use.

5.1.1.2 Sample Labels

Sample labels are necessary to prevent misidentification of samples. Preprinted labels will be provided prior to the sampling activities. Each label will contain space for the following information: sample location/identification, project number, date and time of sample collection, name of sampler, preservatives, and types of analyses to be performed.

5.1.1.3 Chain-of-Custody Record

A Chain-of-Custody (COC) form will be completed to record the custody of every sample collected. A COC form will accompany every shipment of samples to the analytical laboratory in order to establish the documentation necessary to trace sample possession from the time of sample collection through sample analysis. The sample portion of the COC form will include the following:

- Project number, name and location;
- Sample identification;
- Name of Project Manager, Sampler, and Recorder;
- Sampling information (sampling area, depth, media type, type of sample, date and time of collection, etc.);
- Analysis to be performed;
- Preservatives used, if any; and
- Signatures of persons involved in the COC possession, including dates.

When a Chain-of-Custody form is filled out, one page of the three-part form is retained and placed in a file at the on-site office. The other two parts of the form accompany the sample to the laboratory. One of those pages is retained by the laboratory and the other is returned with the sample result report. When the sample report is received, it is cross-checked with the COC file record and both COC pages and the laboratory report are placed in a file in fireproof storage. The analytical result is also entered into a computer database consisting of a comprehensive list of all samples taken at the site and the analytical results.

5.1.2 Laboratory Custody

NET will be the primary laboratory for all sample analysis. The custody for each sample will be transferred by the signing of the COC record by the receiving laboratory sample custodian. NET maintains strict written protocol for internal sample custody.

Upon receipt of samples, information on the COC shipped with samples will be verified and recorded as to agreement or non-agreement. Labels will be checked for notation of proper preservation. If there is an apparent document non-agreement or incorrect preservation noted, the apparent problem will be recorded and the Project Manager notified. Samples will also be checked for leaking or broken containers. The samples will then be marked or labeled with laboratory sample numbers. Samples will be placed in appropriate storage and/or secure areas to await analysis.

5.1.3 Final Evidence Files

The final evidence file will be the central repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. ENTACT is the custodian of the evidence file and maintains the contents of the evidence files for the Phase I Workplan, including all relevant reports, records, logs, field notes, pictures, and data reviews in a secured, limited access area under the custody of the ENTACT project manager or central office file manager. At the completion of field activities, all elements of the final evidence file will be transferred to ENTACT's office in Wood Dale, Illinois.

5.2 Shipping Procedures

For shipping, all samples will be packaged in such a manner as to prevent damage or breakage during shipment or transport. Samples not delivered to the laboratory will be shipped through an overnight parcel service by sampling personnel. Samples will be placed into suitable containers, labeled and sealed in such a manner that tampering with the seal would be obvious. All sample holding times will be tracked and a copy of the Chain-of-Custody form will accompany the samples in a sealed plastic bag. Sample shipping is also discussed in the Phase I time-critical Work Plan as section 3.11.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

Proper calibration, maintenance, and use of instruments and equipment is imperative to ensure the quality of all data collected. A record of calibration and maintenance activities is important to provide legally defendable data.

Instruments and equipment used to gather, generate or measure environmental and physical testing data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility are consistent with the manufacturer's specifications. Calibration procedures and frequency of laboratory instrumentation will be specified in the laboratory quality assurance manual.

6.1 Field Instrument Calibration

All instruments and equipment used for the Phase I time-critical removal action will be inspected to ensure that the item meets and performs to manufacturer specifications and project specifications. Instruments meeting these requirements are issued to a field technician trained in instrument operation and made available for site use. Field instrument operation and calibration are discussed for the specific equipment in Section 3.0 of the Phase I time-critical Workplan.

A record of the instrument calibration will be maintained in a bound field notebook and these records will be subject to a QA audit. Information recorded will include the following:

- Date of calibration;
- All data pertaining to the calibration procedures;
- Initials of analyst performing calibration;
- Adjustments made to equipment prior to and following calibration; and
- Record of equipment failure or inability to meet specifications.

6.2 Laboratory Instrument Calibration

The laboratory instruments used during analysis of samples will be calibrated according to and at the frequency indicated by the QA and QC procedures for each testing method used and any additional manufacturer's recommendations. Records of calibration, repair, or replacement will be filed and maintained by the designated laboratory personnel performing analyses and quality control activities. Calibration records of assigned laboratories will be filed and maintained at the laboratory location where the work is performed.

7.0 ANALYTICAL PROCEDURES

7.1 Field Analytical Procedures

Field analytical procedures consist of operation of a X-Ray Fluorescence analyzer (XRF). Operational procedures for these instruments are described in Section 3.0 of the Phase I time-critical Workplan.

7.2 Laboratory Analytical Procedures

The Phase I analytical parameters and their specified analytical method are listed in Table 3-1 of the Phase I workplan. NET, Bartlett, Illinois, will analyze all samples in accordance with the specified methods and perform all laboratory calibration checks and quality control checks specified by the methods. NET's Quality Assurance Plan is available upon request.

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 Field Quality Control Checks

This section describes all specific quality control checks to be addressed for both field and laboratory analysis in order to comply with the requirements of the Phase I time-critical removal action. It will include, but not be limited to, the following information.

8.1.1 XRF Instrument

The XRF instrument is standardized daily using site specific reference standards. These reference standards consist of site specific soils and are prepared by an analytical laboratory. The XRF reading of each standard is noted. The XRF will also be calibrated using site-specific soil analytical data as described in Section 3.0 of the Workplan.

8.1.2 Field Quality Control of Analytical Samples

Field quality control will also be checked by equipment rinsate blanks and field duplicates. These samples were discussed in Section 3.6 of this QAPP.

8.2 Laboratory Quality Control Checks

Laboratory QC checks are accomplished through the use of system checks and QC samples that are introduced into the sample analysis stream. At a minimum, the following laboratory system checks and QC samples for inorganics will be performed.

- Method blank - All reagents are added to the blank in the same volumes or proportions as used in sample processing and is carried through the complete sample preparation and analytical procedure. Method blanks will be performed at a rate of 1 per sample batch not to exceed 20 samples. A batch is a group of samples which are processed as a unit and prepared using the same reagent lot. If a batch exceeds 20 samples, then each group of

20 samples or less will be considered a separate batch.

- Matrix duplicate samples - Intralaboratory split samples which are analyzed to check for analytical precision of a method within the matrix. Matrix duplicates will be performed at a rate of 1 per batch not to exceed 20 samples.

- Matrix spike samples - A sample spiked with a known concentration of target analyte prior to preparation and analysis. One matrix spike will be analyzed for every batch of 20 or fewer investigative samples per sample matrix.

- Instrument calibration checks to be performed in accordance with the approved analytical method being employed.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

All data collected will be reduced, managed, distributed, and preserved in a manner which substantiates and documents that data are of known quality. An outline of the QC data handling process for data collection, reduction, validation, transfer, reporting, and storage for both field and laboratory data is as follows:

9.1 Data Reduction

9.1.1 Field Data Reduction

The main instrument to be used in the field during this and that requires field data reduction is the XRF analyzer.

The Spectrace 9000 field portable XRF is a direct read device. However, operational procedures require that the instrument be standardized daily. Site specific matrix reference standards are prepared by an analytical laboratory. Three reference standards for lead are used to standardize the instrument. The standards are stored in XRF compatible plastic analysis cups. Each cup is placed in the analysis chamber and a total lead analysis is performed. The direct read result is recorded in the calibration log book. The reading which is the lowest as compared to the reference standard analyzed is used for the calculation adjustment so that the screening will be conservative.

9.1.2 Laboratory Data Reduction

Raw laboratory data will be recorded in a laboratory notebook along with other pertinent information, such as the sample identification number. Other information to be recorded includes: laboratory procedure used, name of analyst, date of analysis, matrix sampled, reagent concentrations and instrument settings. Copies of any strip chart printouts, such as gas chromatograms, will be maintained on file. The laboratory QA Manager makes periodic reviews of these notebooks prior to final data reporting. Equations to be employed

in data reduction are those outlined in the approved method. Data from laboratory quality control samples will be compared to the method acceptance criteria. Unacceptable data shall be appropriately qualified on the results report. Case narratives will be prepared with information concerning data not within acceptance limits and any other anomalous conditions encountered during analysis. Once this procedure has been completed and the results have been released by the laboratory QA Manager, the data are ready for third party validation.

9.2 Data Validation

Technical data, including field data and results of laboratory sample analyses, will be validated to monitor the performance of the removal action. Procedures for validating field and laboratory data are described below.

9.2.1 Procedures Used to Validate Field Data

Validation of data obtained from field measurements will be performed by the QA Officer. Field data requiring validation includes the daily standardization of the XRF analyzer. The QA Officer shall check the calculation and confirm that the adjusted criteria was used for the total lead field screening activities for that day. Other field validation procedures include a review of log books and proofing data entered into the computer database for transcription errors.

9.2.2 Procedures Used to Validate Lab Data

Under the direction of the laboratory QA Manager, the laboratory will review all analytical data to ensure that results for samples meet all method specified criteria. The requirements to be checked by the laboratory in data validation, as appropriate to the analysis, are:

- Sample Holding Times
- Calibration

- Blanks
- Matrix Spike/Matrix Spike Duplicate
- Field Duplicate
- Target Compound Identification
- Interference Check Sample Analysis
- Compound Quantitation and Reported Detection Limits
- System Performance
- Overall Assessment of Data
- Laboratory Control Sample Analysis

Data which do not meet the quality objectives will be noted. Case narratives will be prepared with information concerning data not within acceptance limits and any other anomalous conditions encountered during analysis.

9.3 Data Reporting

Data generated during the Phase I removal activities will be summarized in monthly progress reports, and included in the final report. The QA Manager will develop a data storage and information system to facilitate tracking, data calculations, and transfer of data to various forms and reports. Data reporting procedures are as follows.

9.3.1 Field Data Reporting

Data reporting will be performed by the QA Officer and/or Project Manager. All data collected in the field will go through data validation procedures and be put into a database in an organized format so that intermittent and final summaries may be easily generated for data review.

9.3.2 Laboratory Data Reporting

After laboratory data validation, the laboratory will prepare reports which will include at a

minimum the following components:

- Sample identification
- Laboratory cross-reference numbers
- Date of issuance
- Analysis method numbers performed
- Results from analyses
- Notation of any data qualifiers

The case narratives, to be prepared in the case of questionable or unacceptable results will include at a minimum:

- Date of issuance
- Project name and number
- Analytical tests performed
- Any deviations from the intended analytical strategy
- Laboratory batch number
- Number of samples and respective matrices
- Condition of samples
- Discussion of holding times
- Discussion of technical problems or observations
- Discussion of quality control checks which failed
- Sample description information
- Analytical results
- Quality control reports
- Description of analytical methodology
- Description of QC methodology
- Signature of Laboratory QC/Operations Manager

Data validation packages to be prepared for 10% of the sample results reported shall include:

- Summary page indicating dates of analyses for samples and laboratory quality control checks
- Cross referencing of laboratory sample to project sample identification numbers
- Data qualifiers to be used should be adequately described
- Sample preparation and analytical methods
- Sample results
- Raw data for sample results and laboratory quality control samples
- Results of (dated) initial and continuing calibration checks, and GC/MS tuning results, where applicable
- Matrix spike and matrix spike duplicate (if performed) recoveries, laboratory control samples, method blank results and calibration checks

10.0 PERFORMANCE AND SYSTEMS AUDITS

Performance audits and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the Phase I Workplan and this QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

System audits consist of quantitative evaluation of field and laboratory quality control measurement systems to determine if they are used appropriately. These audits may be carried out before all systems are operational, during the program, or after the completion of the program. These audits involve a comparison of the activities presented in the QA plan with those actually scheduled or performed.

Performance audits are a quantitative evaluation of the measurement systems of the program. They require testing of the measurement systems with samples of known composition or behavior to evaluate precision and accuracy after systems are operational and generating data.

10.1 Field Performance and System Audits

10.1.1 Internal Field Audits

Due to the relatively short period of field time for this Phase I, the internal field audit tasks will be performed by the Project Manager. The audit will include examination of field activity log books, field instrument calibration and standardizing, sample collection, handling, packaging and chain-of-custody procedures and QA procedures.

10.1.2 External Field Audits

External field audits may be conducted by U.S. EPA representatives at any time during the project and may or may not be announced.

10.2 Laboratory Performance and System Audits

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the Phase I Workplan and this QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

10.2.1 Internal Laboratory Audits

Internal lab performance audits are usually conducted on a quarterly basis and consist of preparing and submitting blind QC samples along with other project samples. These samples consist of either blind duplicates or field spiked samples. The QA Officer evaluates the analytical results to ensure that the laboratory maintains acceptable QC performance.

Due to the short length of the Phase I, one internal laboratory audit will be conducted by the QA Officer and/or the contractor's corporate office technical coordinator. An internal lab system audit will be performed at least once during the Phase I project. The system audit will include an examination of laboratory documentation procedures on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc.

10.2.2 External Laboratory Audits

External laboratory audits may be conducted at any time by U.S. EPA representatives and may or may not be announced.

11.0 PREVENTATIVE MAINTENANCE

To minimize the occurrence of instrument failure and other system malfunctions, a preventative maintenance program for field and laboratory instruments will be implemented. Equipment, instruments, tools, gauges, and other items requiring preventative maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedures developed by the operators. Maintenance items that cannot be performed by the laboratory technician will be performed by a person certified to repair the instrument. The laboratory will be responsible for performing routine maintenance and will have available tools and spare parts to conduct routine maintenance. A backup XRF unit will be available for use in the case of a malfunction to avoid downtime.

Manufacturer's procedures identify the schedule for servicing critical items in order to minimize the downtime for the measurement system. It will be the responsibility of the field instrument operator and the laboratory to adhere to this maintenance schedule and arrange any necessary and prompt service. In the absence of any manufacturer recommended maintenance criteria, a maintenance procedure will be developed by the operator based upon experience and previous use of the equipment. Service to the equipment, instruments, tools, gauges, etc., shall be performed by qualified personnel.

Logs will be used to record maintenance and service procedures. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Any items found to be inoperable will be taken out of use and a note stating the time and date of this action will be made in the calibration sheets and logs. The reason for equipment failure and the time and date of its return to service will also be noted in the logbook. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the site. The Project Manager will audit these procedures.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

This section outlines the QA and QC procedures used in assessing the quality of the chemical data. The data evaluation procedures will be used by the QA Manager for assessing duplicate and/or spike/duplicate spike samples and checking any blank samples that are submitted blind to the analytical laboratories from the field or generated internally by the laboratory, in accordance with this QAPP. The purpose of implementing these procedures is to assess the chemical data generated for accuracy, precision, representativeness, and completeness for both the laboratory analytical program and field sample collection activities.

12.1 Precision Assessment

Precision is assessed by dividing a sample or a spiked sample into equal aliquots. The duplicate samples are then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the duplicate samples are calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{\text{Amount in Sample - Amount in Duplicate}}{0.5\ (\text{Amount in Sample + Amount in Duplicate})} \times 100$$

12.2 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample is randomly selected from each sample shipment received at the laboratory, and spiked with a known amount of the analyte to be evaluated. A sample spike will be included in every set of 20 samples tested on each instrument. The spike sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery.

Daily control charts are plotted for each commonly analyzed compound and recorded. The percent recovery for a spiked sample is calculated according to the following formula:

$$\% \text{ Recovery} = \frac{\text{Amount in spiked sample - Amount in sample}}{\text{Known amount added}} \times 100$$

12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{(Number of valid measurements)}}{\text{(Number of measurements planned)}} \times 100$$

13.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out of quality performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the QA Officer or Project Manager.

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected. When a significant condition adverse to quality is noted at the site, laboratory, or subcontractor locations, the cause of the condition will be determined and corrective action taken immediately. All project personnel have the responsibility to promptly identify, solicit approved correction, and report conditions adverse to quality. Conditions which warrant corrective action include:

- Predetermined acceptance standards are not attained;
- Procedures or data compiled are determined to be faulty;
- Equipment or instrumentation is found faulty;
- Samples and test results are questionably traceable;
- Quality assurance requirements have been violated;
- System and performance audits indicate problems.

13.1 Field Corrective Action

The need for corrective action will be identified as a result of the field audits previously described. If problems become apparent that are identified as originating in the field, immediate corrective action will take place. If immediate corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. When a corrective action is implemented the effectiveness of the action will be verified such that the end

result is elimination of the problem.

Corrective action in the field can be needed when the sample network is changed, sampling procedures, and field analytical procedures require modification due to unexpected conditions. In general the QA Officer or the Project Manager may identify the need for corrective action. The field staff in consultation with the Project Manager will recommend the corrective action. It will be the responsibility of the QA Officer and the Project Manager to ensure that corrective action has been implemented.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. Corrective action will be implemented and documented in the field record book and in quality assurance reports to the entire project management.

13.2 Laboratory Corrective Action

The need for corrective action resulting from QA audits will be initiated by the laboratory QA and QC Manager in consultation with the Operations Manager. The corrective actions will be performed prior to the release of data from the laboratory. The corrective action will be documented in the logbook and submitted to the data validator. If the corrective action does not rectify the situation, the laboratory will contact the ENTACT Project Manager or QA Officer. If the nonconformance causes project objectives not to be achieved, it will be necessary to inform all levels of ENTACT management at the site and the US EPA RPM. Corrective action may include, but is not limited to:

- Reanalyzing the samples, if holding time criteria permit;
- Evaluating and amending sampling and analytical procedures;
- Accepting data with an acknowledged level of uncertainty; and
- Resampling and analysis, if the completeness of the data set or intended use of the data is recognized during a preliminary review to be insufficient to meet program objectives.

13.3 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysisof samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the required quality assurance objectives (e.g. the holding time has not been exceeded, etc.). The QA Officer is responsible for identifying a corrective action situation, documenting the incident, determining the course of action, and implementing the corrective action.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

14.1 Contents of a Project QA Report

Analytical results of samples analyzed during the remedial action will be submitted to the Project Leader following a QA and QC review. The results will include a tabulation of the analytical data and an explanation of any field conditions or laboratory QA and QC problems and their effects on data quality. Results of performance audits and system audits will also be included, as appropriate. Proposed corrective action will be recommended in the event that QA problems are identified during review of data quality or results of performance or system audits.

The final report will contain a discussion of QA and QC evaluations summarizing the quality of the data collected and/or used as appropriate to each activity of the project. The objective of the QA and QC summary will be to ensure that the data are representative of site conditions and sufficient in quality and quantity to support the field activities. The QA and QC summary will include:

- Tabulated results of all field and analytical data;
- A report from the laboratory QA Manager evaluating the validity of the analytical data with respect to accuracy, precision, completeness, and representativeness; and
- A report from the Project Leader evaluating the results of field and office audits.

A quality assurance report will be prepared by the QA Manager upon receipt of sufficient QA data from the laboratory. The report will be a summary of QA and QC results of the analytical work conducted and will be included as part of the final remedial action report.

PHASE I: REMOVAL ACTION WORKPLAN

HEALTH AND SAFETY POLICY

Master Metals Site
Cleveland, Ohio

It is the policy of ENTACT, Inc. to conduct all operations with a maximum of safety. No phase of our operation is or shall be considered more important than accident and injury prevention with its aims of eliminating personal injury to members of the public and our associates, property damage and the needless suffering and waste that follows. Therefore, we have adopted a Loss Control Program which has been implemented at all of our locations. It is the responsibility of all ENTACT associates to fully comply with this program and to promote safety consciousness in all of our endeavors. Your assistance and cooperation in this regard is essential.

1997

HEALTH AND SAFETY PLAN (HASP)
COMPLIANCE AGREEMENT FORM

Project Name: _____

Project Supervisor (PS): _____

Project Health and Safety Officer (HSO): _____

The individuals whose names appear below certify that they have obtained and read a copy of the HASP for the above-named project, that they understand the contents of the HASP, and that they agree to comply with all of its provisions. It is further understood and agreed that individuals who violate the policies and procedures in the HASP may be prohibited from working on the project.

Name/Title	Company	Signature	Date

HEALTH AND SAFETY PLAN (HASP) APPROVALS
MASTER METALS SITE
CLEVELAND, OHIO

_____	_____
Project Health & Safety Director	Date
_____	_____
Project Supervisor/Health & Safety Officer	Date

DISCLAIMER

This Health and Safety Plan (HASP) is intended for use only by the employees of ENTACT, Inc., (Contractor). This HASP has been developed, as required by the Administrative Order on Consent entered into by Master Metals, Inc. Site, Cleveland, Ohio and EPA Region V to minimize the potential for contaminant overexposure or injury to Contractor employees engaged in field work at the Master Metals Inc. Site, Cleveland, Ohio and to comply with existing regulatory requirements, including 29 CFR 1910.120(b)(iv). The Contractor's responsibilities hereunder shall extend only to its own employees. This HASP is based solely on currently available data and is not to be relied upon or used in any way, except as a reference document, by any other person or entity without the express written approval of the Contractor.

The Contractor assumes no responsibility to any non-Contractor personnel or entity for the implementation of the plan or for any changes to the plan necessitated by actual site conditions, changing work requirements, and/or decisions made by the EPA, any potentially responsible parties, and/or any personnel working on their behalf.

Any subcontractors working on-site on behalf of the Contractor will be responsible for reading this HASP and implementing the outlined procedures. It will be the responsibility of each subcontractor to enforce this HASP and to ensure that adequate training and proper personal protective equipment is provided to their employees. Any subcontractor found to be in non-compliance with this HASP will be removed from the site. Furthermore, nothing contained herein is intended to remove any existing responsibility for all persons or entities entering the site to comply with all applicable OSHA requirements including, but not limited to, those set forth in 29 CFR 1910.

PHASE I: REMOVAL ACTION WORKPLAN

HEALTH AND SAFETY PLAN

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SECTION 4.0 PERSONAL PROTECTIVE EQUIPMENT (CONT)

SECTION 1.0 SAFETY OVERVIEW

The purpose for this Health and Safety Plan (HASP) is to set forth, in an orderly and logical fashion, appropriate safety procedures to be followed during on-site removal activities at the **Master Metals Site** in Cleveland, Ohio by ENTACT, Inc.. ENTACT's mission is to provide cost effective and timely environmental solutions, but to do so while maintaining the industry benchmark for health and safety on each project. With this as our goal, the following Health and Safety Plan program will be implemented at the **Master Metals Site**.

ENTACT will be performing the following activities as it pertains to the site:

Mobilization;
Site Preparation;
Sampling and Analysis of Waste Materials and Contamination;
Delineation of Waste Materials and the Extent of Contamination;
Long-term Securing of the Facility;
Excavation, Demolition, Consolidation, and Removal of Waste Materials and Contamination; and
Containment, Treatment, Disposal, or Incineration of Hazardous Materials.

During all phases ENTACT will maintain an ongoing safety process and therefore will continually instruct, promote and prepare all associates for their positions. It is through this work process that ENTACT will achieve a safe work environment.

"Safety is a state of mind", therefore all associates have been encouraged to possess a positive attitude toward safety. ENTACT has educated, trained and enforced safety on all projects to date and will continue to stress the importance of proper health and safety procedures on the **Master Metals Site.**

1.1 PURPOSE

The purpose of the **ENTACT** Safety Program is to establish personnel protection standards and mandatory safety practices that will be used for all projects, with special attention to training and reporting requirements. Sections of this plan, most particularly Emergency Procedures, Personal Protective Equipment, Air Monitoring, Materials of Concern, Risk Assessment, Demolition, and the Decontamination section are summaries of detailed health and safety procedures. Taking into

consideration the specific site's health and safety requirements this plan has been developed for the **Master Metals** location. All guidelines set forth in this manual will be strictly adhered to.

The **ENTACT** Safety Program encompasses all insured liability exposures; Workman's Compensation, Auto Liability and General Liability, as exemplified in their corporate safety manual. In addition, the Safety Program is based upon selective hiring, continuous training, inspection/monitoring and incentive programs.

All of the operations, equipment, and procedures at the site, and training and medical monitoring of personnel will comply with the requirements of OSHA 29 CFR 1910.120, and with the applicable subparts of the OSHA construction, and General Industry standards, 29 CFR 1926 and 29 CFR 1910, respectively.

1.2 KEY PERSONNEL AND ORGANIZATION

Personnel that will be responsible for the implementation and support of this Health and Safety Plan are:

Project Coordinator	Dean Pisani
Field Project Managers	Rob Santoro and Erich Kissick
Site Health and Safety Officer	Don Self
Information\Data Coordinator	Shane Banks
Technical\Engineering Support	Michael DeRosa

2.0 GENERAL SAFETY POLICY

2.1 GENERAL SAFETY RULES

The following guidelines have been implemented and are constantly monitored and reviewed, so as to fully comply with ENTACT's objective of keeping a safe and healthy work environment for all our associates and customers:

1. Horseplay, running, or jumping of any obstacles is unacceptable and disciplinary action could be enforced up to and including termination.

2. Associates, visitors, and/or subcontractors will observe and comply with all posted danger, warning, caution, unauthorized areas signs.

3. There will be no unauthorized use or operation of **ENTACT** or customers equipment.

4. Other unsafe acts such as jumping from a vehicle or structure, running or throwing objects is unacceptable.

5. Use or possession of narcotics, intoxicating substances, or guns and ammunition is prohibited.

6. Reporting for work under the influence of narcotics or intoxicating substances.
   NOTE: If on prescription drugs with a "stated" warning, let supervisor know.

7. Company Representative, designee, and **ENTACT, Inc.** Health and Safety representative are authorized to stop any work which they may consider hazardous to Company personnel or equipment or subcontractor personnel.

8. Associates have a responsibility to report for work on time and in condition to work in a safe and efficient manner. An "associate," as used in this Health and Safety plan, is any ENTACT employee.

9. The safety and security regulations of our customers must be strictly adhered to. This also applies to government standards and regulations.

10. Associates are required to verbally report any injury or incident to their supervisor, no matter how small it may seem. Failure to do so before leaving work that day, may result in a delay or denial of benefits you may otherwise be entitled to. A written report should follow as soon as possible.

11. Before setting up operations, take a few moments to locate the nearest phone, eye wash, emergency shower, and fire alarm.

12. Tampering with or by-passing any safety device will not be tolerated.

13. Before setting up your operations, check the surrounding area for potential hazards and conflicts; overhead cranes, plant traffic, including railroads, workers in area, electrical wires, etc.

14. You should inform your supervisor of any incident or problem which may have occurred during that shift immediately. This would include, but not be limited to, injuries, near misses, faulty or defective equipment, use of fire extinguisher, customer requests or concerns, damage to equipment, vehicular accident, etc.

15. Smoking and the use of open flames are strictly prohibited in areas where flammable liquids, gases, or highly combustible materials are stored, handled, or processed, and also in the decontamination or exclusion zones. Obey "NO SMOKING" signs. Smoke only in designated areas.

16. All posted warning, safety, and security signs and barriers shall be observed. Additionally, **ENTACT** shall provide warning signs, barriers, barricades, etc., wherever such protection is needed. Where signs and barricades do not provide adequate protection, particularly along a road way, personnel equipped with warning flags will be used.

17. **ENTACT** personnel will not be permitted to use hoists and powered apparatus belonging to customers unless approval is obtained in each instance from the customer and **ENTACT** representative.

18. **ENTACT** personnel will not be permitted to carry cameras or take pictures without prior approval from the customer. If progress or finished construction photographs are

desired, request for same should be made through the **ENTACT** representative and/or the customer representative and security.

19. Prior to beginning work, associates will be instructed on emergency procedures to be followed. The supervisor is responsible for notifying the associates of emergency situations and the evacuation. In the event of an evacuation, do not go home or leave the work site until released by your supervisor.

20. Areas sealed with polyethylene may become slick especially when disposable booties are worn - extra caution should be taken to secure footing and maintain proper balance during these situations.

21. Working from elevated platforms, scaffolding, and ladders can pose a great danger. Do not overreach, move ladder, scaffold or platform. Avoid shortcuts on scaffolding, ladders, and platforms. All provision of 29 CFR 1926 Subpart L must be complied with when working in or around platform, scaffolding, and ladders.

22. Good housekeeping procedures will be maintained during all project operations. Tools, materials, and equipment are more easily located and placed into service when good housekeeping procedures are followed.

23. Associates are prohibited from the unauthorized removal of any property or Company materials without the special authorization. Associates involved with theft of company property without authorization are subject to immediate termination. Associates involved in theft activities are also liable to the company for full restitution of monies and/or properties taken from ENTACT, and are subject to criminal prosecution by the Company. Theft of Company property, clients property, or personal property belonging to associates will not be tolerated, and violators will be prosecuted.

24. Associates are cautioned that the Company will not be responsible for loss of personal property due to theft. Associates are advised to leave jewelry items, valuables, and personal items in a locked and secured area away from the job site.

25. Associates will wear all required personal safety protective equipment as required by **ENTACT**, while inside or outside the containment areas or hot zones.

26. Associates, visitors, and subcontractors are required to be dressed in the proper work uniforms at all times as per the requirements of the job.

27. Associates will obtain proper authorization prior to leaving the job site.

28. Safety guards, safety plugs, and/or any other electrical safety device shall not be bypassed, removed, or compromised in any way.

29. Step ladders, scaffolding, and/or platforms are to be used as designed and instructed by the supervisor. Step ladders are to be used in the fully extended position only.

30. Respiratory equipment will be worn properly in accordance with EPA and OSHA rules.

31. Respiratory equipment will be kept clean and sanitary for reuse. Respirators not in use will be cleaned and stored in sealed protective bags.

32. Respirator cartridges new or used will be kept clean at all times. Cartridges that are spent should be properly discarded to prevent accidental re-use.

33. Optical eye-wear other than industrial safety eye-wear is prohibited from use on the job site.

34. Safety belts and lanyards are to be worn properly when required.

35. Specific maintenance and service to equipment and/or tools is to be conducted only by skilled maintenance personnel. Equipment used at the site will be inspected daily by a competent person.

36. Intentional violations of associate rights concerning health and physical well being will be cause for termination. Willfully causing an accident and/or injury to ones self or to a fellow employee will be cause for immediate termination.

37. Hand tools are to be used for the specific purpose of their design. Hand tools, electrical tools, and mechanically operated tools are to be free of any form of tape.

38. Waste identification labels will not be applied to any material which does not

correspond with label (i.e. hazardous waste labels).

39. All safety equipment, and tools are to be inspected for defects routinely by each employee prior to use. Damaged tools or equipment must be reported immediately to a supervisor and taken out of service.

40. All job site personnel must be aware of and know where to locate all fire extinguisher and emergency evacuation routes.

41. Hand tools are not to be left on the floor, scaffolding, ledges, and/or ladders.

42. Extension type ladders should be used with a 1 to 4 ratio - one foot out for every four feet of elevation.

43. Ladder users will face the ladder while ascending and descending. The top and second to top steps are not to be used for standing. Only one person at a time on a ladder. Bracing on the back of the ladder should not be used for climbing. Ladders should be secured to a fixed object when possible.

44. Guardrails and toe boards should always be installed on scaffolding. Workers should be careful to keep all debris bagged and obstacles off the floor. All components such as cross braces, railing, pin connectors, planking, toe boards, or scaffold grade lumber should be available before the unit is assembled.

45. Mobile scaffolding base dimensions should be at least one-half of the height. Scaffolding ten feet high or higher must have rigid guardrails.

46. All electrical equipment used on the job site will have electrical grounding devices with ground fault circuit interrupters. An extension cord without a ground wire plug is never to be used. Damaged electrical cords will be discarded or turned into the office for repair. All electrical cords and boxes are to be considered live until tested otherwise. Never spray water on or near open panels or electrical boxes. All 110v, 15-20 amp circuits must be protected with ground fault circuitry, or an assured grounding program.

47. **ENTACT** requires that an electrical lock out program be in effect at all job sites. A limited number of padlock keys will be issued with electrical lockouts. A written log

entry will be made any time a lock out procedure goes into effect.

48. Hand held electrical tools must be unplugged prior to any servicing.

49. While preparing to do work around energized equipment such as transformers and/or electrical panel boxes, all aspects of 29 CR 1926 Subpart K must be complied with. Equipment that cannot be de-energized during the abatement, will be covered and sealed on three sides only. There must be adequate ventilation to the panels and or boxes, or else there is the possibility and danger of explosion.

2.2 MOTOR VEHICLES

1. Any person operating a company vehicle must have a current, valid and appropriate driver's license. In addition, all applicants considered for positions which include driving a company vehicle, will be subject to a Motor Vehicle Record search and evaluation.

2. All company vehicles must be equipped with a first aid kit at all times.

3. All company vehicles must be equipped with a fire extinguisher and flares or reflectors.

4. All company vehicles must be maintained in good mechanical condition. A pre-trip inspection shall be performed, and any defects or malfunctions must be reported to the supervisor before the vehicle leaves the yard.

5. The number of persons inside the vehicle shall be limited by the number of seat belts available for use.

6. The driver is responsible to see that he and each authorized passenger is properly wearing a seat belt while riding in a company vehicle.

7. All rules of the road and all customer regulations concerning vehicles must be obeyed.

8. Use extreme caution when backing a vehicle. If at all possible, use a safety person to guide you.

9. All vehicles will be maintained in a clean and orderly manner to prevent injuries and fire

hazards. This includes the cab as well as the inside and outside of the truck.

10. When your job assignment requires you to drive a company vehicle, you are considered to be a professional driver. Failure to drive courteously and to obey the rules of the road may result in the loss of this privilege and termination of your employment.

11. The use of company vehicles shall be restricted to the specific job to which you are assigned. Any unauthorized use will be cause for disciplinary action up to and including discharge.

12. All vehicles must be parked in authorized areas only.

2.3 MOTOR VEHICLE ACCIDENT REPORTING AND GENERAL LIABILITY

When an accident occurs, as soon as the preliminary investigation has been completed and the necessary claims handling actions have been taken (medical care for injured, rental cars obtained, etc.), the accident report must be filled out immediately. The vehicle operator and/or equipment operator, and project manager are responsible for generating the accident report and initial investigation of the accident. The operator must immediately notify the supervisor of all equipment or vehicle damage. The accident report should be submitted to the Accounting Department for file distribution. The Accounting Department will be responsible for reporting all auto/general liability claims involving property damage.

In some states, additional forms and paperwork are required by state and local law enforcement agencies. It is the driver's responsibility to obtain these forms and to submit the properly prepared reports on a timely basis to these additional regulatory agencies.

2.4 ACCIDENT PREVENTION, REPORTING, AND INVESTIGATION

ENTACT, INC. is guided by an established safety policy. This policy is based on a sincere desire to eliminate personal injuries, occupational illnesses, and damage to equipment and property, as well as to protect fellow associates and the general public whenever the public comes in contact with, or is affected by, the Company's work.

ENTACT recognizes associates who implement safety procedures. Those associates who avoid injury and any vehicle accident are recognized on an annual basis. In addition, other incentive programs are implemented and include programs such as short-term safety contests, whereby prizes are awarded to

associates with exceptional safety records. It is the responsibility of the Director of Corporate Safety to determine such additional incentive programs and/or contests.

ENTACT shall provide a verbal report of all accidents, as soon as the injured associate's immediate needs are attended to, a verbal report of all injuries which require medical attention or loss of work time. A written report to Owner's safety inspector shall follow within twenty four (24) hours. In the event of severe injury, death or extensive property damage, **ENTACT** shall notify and assist Owner's investigation team during the inquiry. **ENTACT** shall maintain a log of occupational injuries and illnesses as required by federal law in accordance with the OSHA record keeping requirements of 29 CFR 1904.2

Completed accident documentation appropriate for the accident shall be maintained on site and include the following forms/reports/ summaries: Employer's First Report of Injury or Illness, Owner's Contract Injury Summary Report, Medical Treatment Authorization, Major Incident Report, Automobile Loss Notice, General Liability Loss Notice, Motor Carrier Accident Report, First Aid Register, Monthly Accident Analysis, and a Monthly Preventable Accident Monthly Summary. Copies of the Employer's First Report of Injury or Illness shall be submitted to Owner's safety inspector and construction foremen.

Managers and supervisors are charged with the responsibility of preventing the occurrence of incidents or conditions that could lead to occupational injuries or illness. While it is Management's responsibility to provide a safe environment in which to work, the ultimate success of a safety and health program depends upon the full cooperation of each individual associate.

Safety should never be sacrificed for production. It must be considered an integral part of quality control, cost reduction and job efficiency. Every supervisor will be held accountable for the safety performance demonstrated by the associates under their supervision.

Our goal is the total elimination of accidents from our operations. There are three sound reasons for this goal:

1. No endeavor is worthy if it should cause human suffering through disabling injury or loss of life.

2. A good safety record reflects the quality of management, supervision and the work force. It also serves to promote business and thereby contributes to the continuing growth and success of the Company.

3. Poor accident experience increases costs, and results in a loss of profits. Our policy is to accomplish work in the safest possible manner consistent with good work practices. Management at every level is charged with the task of translating this policy into positive actions.

If an injury occurs on the job, no matter how minor, the supervisor is to be notified immediately so that appropriate medical treatment can be administered. As soon as possible thereafter, an Accident Report will be completed by the responsible supervisor.

Failure to report an accident immediately after it happens may result in dismissal and/or delay or denial of Workers' Compensation benefits.

All accidents and near accidents will be immediately investigated by the responsible project supervisor, the company safety officer, and management. Investigations will be conducted in accordance with the investigation format outlined in **ENTACT**'s accident investigation report (see attached). Information will be obtained from witnesses, the first report of injury, the victim, and other sources which may be available.

2.5 SITE SPECIFIC HEALTH AND SAFETY PLAN

A site specific Health and Safety Plan will be developed for each plant site where activities are expected to take place. The plan will address safety and health issues associated with the performance of work at that location. Chemical and physical hazards will be identified and appropriate safety precautions and personal protective equipment designated. The plan will also specify emergency procedures including escape routes and routes to emergency facilities. The plan will also list the emergency contacts and phone numbers. The Health and Safety Plan consists of two parts. The first section addresses generic safety and health concerns pertaining to a chemical plant or refinery environment. The second section is in fill-in-the-blank format to be completed jointly by the responsible safety and health and project management personnel assigned to the project.

Pertinent and/or required safety information and other appropriate information will be posted on a bulletin board or other fixture at each job site for access by company and customer employees. A copy of the company safety policy and the job specific Safety and Health Plan will also be available at each job site for reference by company or customer personnel.

Prior to beginning work, a pre-job meeting is held with a specific agenda addressed (copy is attached). All personnel who will be involved with the project will attend. The site specific Health and Safety Plan will

be reviewed in detail and specific concerns discussed. Project related logistics, scheduling, equipment, and personnel will be reviewed as well as any items regarding regulatory compliance and plant safety rules and regulations.

2.6 ORIENTATION TO JOB SITE, PLANT RULES, AND REGULATIONS

All company personnel and subcontractors are required to attend the project pre-job meeting as well as weekly job-site meetings to review the site specific Health and Safety Plan, specific safety and health issues, and plant rules and regulations associated with the project. All meetings held will include, with the meeting notes, an attendance sheet. Each associate attending the meeting will print their name in the appropriate space on the meeting note sheet. At the end of the meeting, each associate attending the meeting will sign the reverse side of the attendance sheet and include their social security number. The original will be kept by the project manager in the job file and a copy will be given to the client for their files.

In order for **ENTACT** to maintain its exceptional safety record, **ENTACT** requires that any subcontractors contracted by **ENTACT** practice and promote **ENTACT's** safety policy or the equivalent thereof. Therefore, all subcontractors must submit a copy of their safety program for review by **ENTACT** prior to the start of any work being performed. Should the subcontractor's safety policy be deemed unacceptable by **ENTACT**, the subcontractor must accept and implement the safety policies of **ENTACT** as a condition of contract.

2.7 MEDICAL PROGRAM AND PERSONNEL SURVEILLANCE

Associates handling hazardous wastes can experience high levels of stress. Their daily tasks may expose them to toxic chemicals, safety hazards, biological hazards, and radiation. They may be subjected to heat stress while wearing protective equipment working under temperature extremes, or face life-threatening emergencies such as explosions or fires. **ENTACT, INC.** believes that a medical program is essential to assess and monitor associates' health and fitness, both prior to and during employment. Emergency phone numbers and local hospital information is contained in Appendix A and B of this manual.

ENTACT, INC. complies with OSHA regulations regarding medical evaluation of associates required to wear a respirator and subjected to other circumstances which dictate other specific medical requirements. Applicants who fail any of the required examinations may not be allowed to work for **ENTACT**. Non-smoking applicants for hazardous materials technician positions will be given first opportunity for

employment over those who smoke due to the inherent risk factors associated with smoking and asbestos abatement and chemical work. Pre-employment physical data is used to evaluate the associates physical capabilities to perform the work assignments in a safe and healthful manner, and to establish a base line medical record on the associate for periodic monitoring.

ENTACT's medical program incorporates 29 CFR 1910.1025 and 29 CFR 1926.58 and the following components:

Pre-employment screening

- Medical History
- Occupational History
- Drug Screen Test
- Pulmonary Function Test
- Chest X-ray

- Audiogram
- Physical Examination
- Determination of fitness to work wearing protective equipment
- Baseline monitoring for specific exposures

Periodic Medical Examination

- Yearly update of medical and occupational history; yearly physical examination; testing with routine medical tests
- Testing for controlled substances
- More frequent testing based on specific exposures

Emergency Treatment

- Emergency first aid on site
- Liaison with local hospital
- Decontamination of victims

Record Keeping and Review

- Maintenance of medical records in accordance with OSHA and state regulations
- Reporting and recording of occupational injuries and illnesses
- Periodic review of site safety plans to determine if additional testing is needed
- Periodic review of entire program. Focus on current site hazards, exposures, and industrial hygiene standards

ENTACT's associates realize adequate protection from exposure through engineering controls, appropriate personal protective equipment, and decontamination procedures to perform work safely and with minimum risk. The company's medical program is used to complement these other controls.

Personnel Medical Surveillance

Although medical monitoring of certain personnel is statutory, **ENTACT, INC.** feels it is the best method of determining the effectiveness of its safety programs. Each associate is required to submit to a thorough physical within the first 30 days of employment in order to establish background levels of potential toxicant. This information is used as a standard for the individual associate throughout that associate's career with **ENTACT**. The associate is required to retest within 30 days of his or her anniversary date of employment each year. The annual retest is then compared to the original physical and any deviation is observed and recorded. Even if the change is slight, the associate will resubmit to a duplicate test to determine accuracy of the first. If the results are confirmed, that associate will not be allowed to repeat the exposure which is suspect for the change from the original test. A physician's written opinion, that shall be furnished to the employee, regarding their ability to perform the work activities, including wearing respiratory protection, at hazardous waste sites as required by 29 CFR 1910.120 (f).

The value of this extensive monitoring is one of **ENTACT, INC.'s** methods of risk management, which not only protects **ENTACT** from a potential loss, but also protects the client. Although **ENTACT, INC.** has a potential risk due to the need to protect its associates, it also provides protection to the client through this program.

A database of all physical examinations, drug tests, training courses, and accidents is kept on all associates and can be accessed at any time. This historical data enables **ENTACT** to direct its safety program toward areas of concern and accurately monitor the training and medical needs of its associates.

The following is the minimum physical to which the associate will be submitted. It should also be noted

that in **ENTACT's** entire history, no associate has had any changes in the test results that could be contributed to an occupational exposure.

- Chest roentgenogram, either posterior or anterior
- Medical history to elicit symptomology of respiratory disease

- Pulmonary function testing to include FVC and FEV 1.0
- Medical examination of the ears to determine existence of punctured or perforated ear drum(s)
- Blood pressure
- Blood metals
- General physical condition
- Eyesight and peripheral vision testing
- List of medications being taken
- History of back injuries
- General medical history
- Testing for controlled substances

2.8 PROHIBITED SUBSTANCE POLICY

ENTACT strives to provide a safe and healthy work environment and protect its operations and facilities. It is the objective of **ENTACT** to maintain a productive and efficient work place. Therefore, **ENTACT** policy prohibits the unlawful manufacture, distribution, dispensation, possession, use, or being under the influence of a controlled substance in the work place. Any associate found to be in violation of this policy shall be subject to discipline, up to and including immediate discharge.

ENTACT's Substance Abuse Policy was created to establish and maintain a safe and healthy work environment for its associates as mandated by the Drug-Free Work Place Act of 1988. "Drug" is defined as any substance, other than alcohol, capable of altering an individual's mood, perception, pain level or judgement. "Controlled Substance" is defined as any substance which can be legally obtained only by prescription by a licensed medical practitioner. "Illegal Drug" is defined as any drug or controlled substance that is generally recognized as illegally sold or consumed.

All applicants for employment will be advised of **ENTACT**'s Drug and Alcohol Policy. A medical screen for drugs is a condition for employment and will be included in the pre-employment physical examination. Positive tests serve as grounds for denial of employment and/or termination. Associates who refuse a

medical screen may be denied employment. The Drug and Alcohol Policy allows **ENTACT** to require an associate to submit to a drug and alcohol test at any time, without prior notice. **ENTACT** may conduct testing on a random basis, prior to employment, in routine physicals, upon reasonable suspicion, or after an incident. **ENTACT** may refuse to hire an applicant who does not sign an agreement consenting to future drug and/or alcohol testing in accordance with company policy.

All associates are expected to abide by the terms of the Drug and Alcohol Policy as a condition of employment. Additionally, all associates are required to notify their immediate supervisor if they are convicted under any criminal drug statute for a violation occurring in the work place no later than five (5) days after the conviction. If an associate is convicted under any criminal drug statute for a violation occurring in the work place, **ENTACT** may at its discretion take appropriate personnel action against the associate, up to and including immediate discharge, and/or require the associate to satisfactorily participate in a drug abuse assistance or rehabilitation program.

Should an associate's drug test yield "positive" results, the associate may be suspended from work for any period of time deemed appropriate or the associate may be discharged. If within thirty (30) days, the associate submits to a drug test which yields "negative" results, the associate may be reinstated if an appropriate position is available. Should an associate receive "positive" results on two drug tests, the associate shall be terminated from employment without option for rehire. The following guidelines are mandatory for all **ENTACT** associates:

1. The use of illegal drugs is prohibited.
2. All associates are prohibited from being under the influence of alcohol, illegal drugs, or any drug not legally prescribed during working hours.
3. The use, sale, purchase, possession, or transfer of any controlled substance other than use as prescribed by a physician while performing company business, on or off company premises, is strictly prohibited and grounds for immediate dismissal.
4. No alcoholic beverages will be bought or consumed on company premises except in connection with company sponsored events. Violation will result in disciplinary action, including dismissal.
5. Associates suspected of being under the influence of alcohol or any illegal drug during working hours, will be suspended immediately and will be required to take a medical screen for drugs.

The **ENTACT** Drug and Alcohol Policy serves as protection for both **ENTACT** and its client. Therefore, compliance with the stated guidelines is mandatory and will ensure a safe, healthy work environment and

reduce substance abuse related accidental injuries to person and property.

2.9 HAZARD COMMUNICATION

It is the associates Right-to-Know about any and all hazardous chemicals that they may be required to work with or becomes exposed to while performing work for ENTACT. Material Safety Data Sheets shall be available to workers at their request in compliance with 29 CFR 1910.1200.

It is the Project Manager's responsibility to keep all associates informed of any chemical hazards associated with the job and/or operation. The Project Manager will conduct pre-work safety meetings with all associates and explain to them all information about exposures to known chemicals, liquid, solid, gaseous, or vapor, and the effects and or side effects related to prolonged exposure or abuse of these chemical substances. During the pre-work safety meetings, associates will be given the opportunity to ask questions about known chemical exposures, and their deleterious effects. The safety meeting shall also include basic first aid measures that are to be taken in the event of overexposure or any other chemical related incident.

Dedicated safety bulletin boards shall be installed at the decontamination trailer, lunch area and safety trailer. **ENTACT** Safety policy and Emergency Contact Telephone Numbers, as well as other pertinent and/or required safety information for the job site will be posted and updated as appropriate.

Hazard Communication and Right-to-Know Legislation

About forty (40) different states and municipalities have enacted "Right-to-Know" legislation that goes beyond the basic notification and access requirements of the Occupational Safety and Health Act. Included are provisions for notifying individuals of potentially hazardous materials and proper means for personal protection prior to their entering the workplace and at least annually thereafter. In addition, an associate is protected from discharge following refusal to work if hazard information is requested and not given within a specified time frame (usually two to four days).

The Occupational Safety and Health Administrator promulgated the Federal equivalent of this Right-to-Know legislation in December 1983 under the name of the Hazard Communication Standard. This standard was originally established to cover the manufacturing industry, but coverage was extended to other non-manufacturing industries on May 23, 1988. On October 1, 1988, the Canadian Workplace Hazardous Materials Information System went into effect requiring essentially the same provisions as the OSHA and state Right-to-Know laws. Additional information concerning this legislation can be found in the ENTACT library.

SECTION 3.0 RESPONSIBILITIES OF PERSONNEL

3.1 PROJECT SAFETY ORGANIZATION AND RESPONSIBILITIES

The responsibilities of each person in the Chain of Command will be defined in the following manner for the implementation of the Health and Safety Site Plan. In some cases, the Chain of Command may be different. If that is the case, the responsibilities may have to be reassigned to fit the situation.

The Chain of Command will show the flow of the decision making process at **ENTACT, INC.** so that delegated responsibilities will be understood.

- President
- Operations Vice-President
- Corporate Safety Officer
- Project Manager
- Assistant Project Manager
- Hazardous Material Technicians

ENTACT's senior management responsibilities include corporate safety and risk management which are:

- Ensuring all safety personnel remain up to date on regulatory requirements and knowledge through continuous training.
- Creating corporate safety policies
- Auditing on-site safety programs for compliance
- Providing all required safety instrumentation needed to detect possible employee exposures
- Coordinating with insurance loss, control personnel in the evaluation of identified hazards.
- Personally investigating all serious losses
- Managing of claim losses

The corporate and project safety organization and personnel assigned are as follows:

Operations Vice-President:	Tim Elms
Corporate Safety Officer:	Troy D. Butt
Project Manager:	Dean Pisani
Assistant Project Managers:	Rob Santoro and Erich Kissick
Hazardous Materials Technicians:	Shane Banks and others to be assigned

3.2 RESPONSIBILITIES OF PERSONNEL

Corporate Safety Officer

- Provide advice on the design of the Work Plan and the Site Safety Plan.
- Occasionally assist Project Managers with the facility inspections.
- Assist Project Managers with the accident investigations.
- Act in an advisory manner to upper management concerning loss control programs.
- Provide safety training to supplement site specific safety training.
- Provide the necessary facilities, equipment, and funds.
- Provide adequate personnel and time resources to conduct activities safely.
- Support the efforts of on-site management.
- Provide appropriate disciplinary action when unsafe acts or practices occur.

Operations Vice-President

- Provide advice on the design of the Work Plan and the Site Safety Plan.
- Provide the necessary facilities, equipment, and funds.
- Provide adequate personnel and time resources to conduct activities safely.
- Support the efforts of on-site management.
- Provide appropriate disciplinary action when unsafe acts or practices occur.
- Occasionally assists in facility inspections and accident investigations.
- Act in an advisory manner to upper management concerning loss control programs.

Project Manager

- Prepares and organizes the background review of the situation, the Work Plan, the Site Safety Plan, and the field team.
- Obtains permission for site access and coordinates activities with appropriate officials.
- Ensures that the Work Plan is completed and on schedule.
- Briefs the Hazardous Material Technicians on their specific assignments.
- Ensures that safety and health requirements are met.
- Serves as the liaison with company and public officials.
- Selects protective clothing and equipment.
- Periodically inspects protective clothing and equipment.
- Ensures that protective clothing and equipment are properly stored and maintained.

- Controls entry and exit at the Access Control Points.
- Coordinates safety and health program activities with the Corporate Safety Officer and Operations Vice-President.
- Confirms each Hazardous Material Technicians' suitability for work based on a physician's recommendation.

Assistant Project Managers

- Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue.
- Monitors on-site hazards and conditions.
- Participates in the preparation of and implements the Site Safety Plan.
- Conducts periodic inspections to determine if the Site Safety Plan is being followed.

- Enforces the "buddy" system.
- Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Notifies, when necessary, local public emergency officials.
- Coordinates emergency medical care.
- Documents field activities and sample collections.
- Serves as liaison with company and public officials in the absence of the Project Manager.
- Maintains a log of communication and site activities.

Hazardous Material Technicians

- Manages field operations.
- Executes the Work Plan and schedule.
- Enforces safety procedures.
- Coordinates with the Project and/or Assistant Project manager in determining protection level.
- Enforces site control.
- Notifies emergency response personnel in the event of an emergency.
- Assists the Project Manager in a rescue, if necessary.
- Assists other field technicians in the clean areas, as needed.
- Maintains line-of-sight and communication contact with the work parties via walkie-talkies, signal horns, or other means.

- As directed, sets up decontamination lines and the decontamination solutions appropriate for the type of chemical contamination on site.
- Controls the decontamination of all equipment, personnel, and samples from the contaminated areas.
- Assists in the disposal of contaminated clothing and materials.
- Ensures that all required equipment is available.

Any one of the above people will have the authority and responsibility to shut down operations, if necessary. All personnel are responsible for being familiar with, understanding and complying with the Site Health and Safety Plan. Associates are responsible for reporting any unsafe acts or conditions, safety incidents, accidents, injuries, or exposure to the Site Safety Officer.

The Project Manager is also responsible for completing the Site Specific Safety Plan and communicate all of the known or suspected hazards to all employees involved in the project.

This Site Specific Safety Plan will be completed for each project and must be readily available along with the General Safety Plan at the work site.

Pertinent and/or required safety information and other appropriate information will be posted on a bulletin board or other fixture at each job site or central location within the plant (e.g. job office) for access by company and customer employees. A copy of the company safety policy and the job specific Safety and Health Plan will also be available for reference by company or customer personnel.

A list of all emergency and National or Regional Sources of Assistance will be included in all safety manuals, emergency response manuals, and posted on the bulletin board and/or with each cellular mobile phone.

All personnel will actively participate in on-going medical monitoring and respiratory protection program.

3.3 APPROVALS

1. The Supervisor shall be required to obtain pertinent work permits or authorizations from the Customer Representatives before:

- working on existing pipelines or equipment
- entering any designated high hazard areas

- entering tanks or closed vessels
- using torches, electrodes, electric motors, forges soldering irons, any open flames, or any device which could produce sparks or ignition source
- closing walkways, roads, or restricting traffic
- starting excavations
- removing tanks from excavation
- backfilling excavation
- using utilities such as steam, water, compressed air, or electricity
- sandblasting, spray painting, or grinding
- storing flammable materials such as gasoline, oil, paints, oxygen cylinders, etc.
- walking or working on roofs of buildings or equipment
- drilling, boring, preparing test pits, or using geophysical equipment or any other exploratory equipment requiring penetration of surfaces
- operating cranes or similar equipment near overhead power lines or pipelines
- opening or cutting through firewalls or berms
- fueling or repairing operating equipment on company property or job sites

2. For security reasons, entrance to and exit from **ENTACT** facilities and job sites is restricted to those areas designed as Contractors work area.

3.4 INSPECTION/MONITORING

As a construction site is constantly undergoing a state of change, it is mandatory that work conditions and associate risk exposures are routinely inspected and monitored. Site safety inspections will be conducted at random on each project with the frequency of inspection dependent upon the duration of the project and potential hazards involved. Site safety inspections will be conducted primarily by the company safety officer and/or the senior responsible project manager. However, company management personnel may on occasion conduct random inspections as well. At least one inspection will be conducted on each project.

Any associate witnessing a safety violation is to report it immediately to the supervisor and/or other responsible company officials as soon as possible. Safety violations will be addressed immediately by the senior project manager and/or company safety officer whichever is most immediately available. Safety violations will be documented and appropriate disciplinary action taken.

3.5 OSHA INSPECTION POLICY

ENTACT commits to a safe and healthful workplace for all of its associates. To accomplish this, the Company welcomes advice and information from the Department of Labor - Occupational Safety and Health Administration on how to better safeguard our facilities. **ENTACT** will comply with any requests from OSHA to enter into a premise under the control of ENTACT for a general inspection.

1. The supervisor will greet the OSHA officer and ask to see the compliance officer's identification.
2. The supervisor will then make a photocopy of the identification presented by the compliance officer, or obtain a business card which correlates with the government identification. If the officer wishes to enter the abatement areas, proof of physical examination must be supplied.
3. Once the compliance officer has provided proper identification, the supervisor will then request information from the officer on why they are requesting an inspection. If the visit is based on a general inspection, then gather the details and advise the officer that you intend to comply with any request to inspect the facility. Please notify the office as soon as possible to inform them of the inspection.
4. The OSHA officer must be accompanied by an **ENTACT** associate during the inspection. The officer must also comply with the personal protective equipment required in the restricted areas.
5. The compliance officer may review OSHA records kept on-site, however the OSHA officer is not permitted to photograph any part of the facility until ENTACT can obtain the client's consent.
6. Upon the compliance officer's departure, the supervisor should write a brief report on all the activities that took place and will forward the collected information to the office.
7. If a compliance officer is responding to a complaint, then this information should be forwarded immediately. When responding, the officer will inspect areas of concern.
8. **ENTACT** associates are advised that they are to be courteous and cooperative at all times with all government inspectors, and/or visitors.

SECTION 4.0 PERSONAL PROTECTIVE EQUIPMENT

4.1 PERSONAL PROTECTIVE EQUIPMENT POLICY

In conditions where a hazard exists, the ideal work environment would be achieved by the use of engineering controls such that the control utilized would either completely remove all hazardous materials/conditions from the work place or fully isolate associates from hazardous materials/conditions. An example of an engineering control is dust suppression accomplished by sprinkling dry, dusty soil with water. Whenever engineering controls can be proven effective and feasible, they will be initiated.

Until the level of protection required within the work area is established by air monitoring, **ENTACT** Personal Protective Equipment Policy shall be consistent with NIOSH minimum Level B. Level C and Level D equipment shall be used only when lesser protection levels are established as appropriate. Refer to Appendix C - Personal Protective Equipment.

Any personal protective equipment issued to the associate by the company is the personal responsibility of the associate. He must ensure that it is kept in a safe and clean condition and in his possession at job sites. When in disrepair, it must be returned for repair or replacement.

In certain construction and maintenance operations, personal protective equipment, such as safety glasses, chemical goggles, respirators, hard hats, and protective clothing is required. The type of protective equipment to be worn will be determined by the degree of exposure to the potential hazard. When in doubt about the safety measures to be observed, employees shall contact the supervisor.

While personal protective equipment reduces the potential for contact with harmful substances, ensuring the health and safety of workers requires, in addition, safe work practices, decontamination, site entry protocols, and other safety considerations. Together these protocols establish a combined approach for reducing potential harm to associates.

Personnel must wear protective equipment when response activities involve known or suspected atmospheric contamination, when vapors, gases or particulates may be generated, or when direct contact with skin-affecting substances may occur. Respirators can protect lungs, gastrointestinal tract, and eyes against air toxicant. Chemical-resistant clothing can protect the skin from contact with skin-destructive and absorbable chemicals. Good personal hygiene limits or prevents ingestion of materials.

The materials of concern present at the site will be established by laboratory analyses of samples obtained

from the job site. The selection of sample media and locations shall be on the basis of those media and locations anticipated to be of greatest concern. A risk analysis will be performed for each material of concern in order to identify the material(s) of greatest concern. The appropriate protective ensemble will be selected on the basis of the risk analysis.

In addition to risks due to contaminants, some physical hazards or hazardous conditions may be present at the site. These include risk of injury while working around heavy equipment, explosive or combustible gas generation, hearing damage from heavy equipment noise, and heat or cold stress.

1. Levels of Protection

Equipment to protect the body against contact with known or anticipated chemical hazards has been divided into four categories according to the degree of protection afforded:

Level A: Should be worn when the highest level of respiratory, skin, and eye protection is needed.

Level B: Should be selected when the highest level of respiratory protection is needed, but lesser level of skin protection. Level B protection is the minimum level recommended for initial site entries until the hazards have been further defined by on-site studies/investigations and appropriate protection utilized.

Level C: Should be selected when the type(s) of airborne substance(s) is known, the concentration(s) is measured, and the criteria for using air-purifying respirators are met.

Level D: Should not be worn on any site with respiratory or skin hazards. It is primarily a work uniform providing minimal protection.

The level of protection selected is based primarily on:

- Types and measured concentrations of the chemical substances in the ambient atmosphere and toxicities.
- Potential or measured exposure to substances in air, splashes of liquids, or other direct contact with material due to work being performed.
- In situations where the types of chemicals, concentrations, and possibilities of contact are not known, the appropriate level of protection is to be selected based on

professional experience and judgement until the hazards can be better characterized.

Personal Protective Equipment Levels:

PPE Level A includes the following items at a minimum;

- Fully-encapsulating, chemical resistant suit
- Inner chemical resistant gloves
- Outer chemical resistant gloves
- Chemical resistant safety boots
- Pressure-demand, full-face supplied air breathing apparatus (SABA)
- SABA cascade system air supply assembly with regulators, and 200' of chemical resistant air supply hose or self contained breathing apparatus (SCBA) with harness and escape pack SCBA
- Safety harness and rope
- Explosion proof light
- Two-way radio communication
- Cooling vest

PPE Level B w/acid suit includes the following items at a minimum;

- One-piece chemical resistant saranex suit with hood and enclosed feet
- Inner chemical resistant gloves
- Outer chemical resistant gloves
- Chemical resistant safety boots
- Pressure-demand, full-face supplied air breathing apparatus (SABA)
- SABA cascade system air supply assembly with regulators, and 200' of chemical resistant air supply hose or self contained breathing apparatus (SCBA) with harness and escape pack SCBA
- Safety harness and rope
- Explosion proof light
- Hearing protection
- Hard hat

PPE Level C w/acid suit includes the following items at a minimum;

- One-piece chemical resistant saranex suit with hood and enclosed feet
- Inner chemical resistant gloves
- Outer chemical resistant gloves

- Chemical resistant safety boots
- Full-face, dual cartridge, air purifying respirator with cartridges
- Safety harness and rope
- Explosion proof light
- Hearing protection
- Hard hat

PPE Level C w/coated tyvek suit includes the following items at a minimum;

- One-piece chemical resistant coated tyvek suit with hood and enclosed feet
- Inner chemical resistant gloves
- Outer chemical resistant gloves
- Chemical resistant safety boots
- Full-face, dual cartridge, air purifying respirator with cartridges
- Safety harness and rope
- Explosion proof light
- Hearing protection
- Hard hat

PPE Level D includes the following items at a minimum:

- Hard hat
- Safety glasses
- Work gloves
- Safety boots
- Hearing protection
- Explosion proof light

2. Eye Protection

Eye protection is required when engaging in such operations as the following:

- drilling, chipping, grinding, wire brushing
- handling caustics and acids
- breaking bricks and concrete
- hammering and chiseling
- at least number 2 shaded eye protection for burning and oxygas welding.
- other situations which create a possible eye hazard, e.g., chemical environments

The following are different types of eye protection used:

- Industrial type safety glasses must be worn. Monogoggles will be worn over regular prescription glasses, if the glasses are not industrial rated.
- A full face shield must be worn while performing any job with high pressure water. A face shield is not to be substituted for safety glasses or goggles, but used in addition to them.
- Chemical splash-guard goggles are required on all operations where solvents, acid, or caustics are used or in the immediate vicinity.
- Appropriate goggles must be worn at any time a hazard exists; such as grinding or chipping operations or welding.
- Sandblasting hoods with plastic face shields and piece protection are required while operating a sandblast gun or nozzle. These must be positive pressure fresh air hoods.

3. Ear Protection

Ear plugs or muffs are required on assignments where the noise level is above ninety (90) decibels. If noise is a problem, workers must wear hearing protection.

4. Hand and Body Protection

Waterproof gloves, wet suits, and rubber boots will provide some protection. Where conditions warrant, additional protection such as acid suits, chemical gloves, metatarsal guards or shin guards must be worn. Personnel using arc welding equipment will comply with 29 CFR 1926.102 and will wear a long sleeve shirt, gloves, head protection, and using a welding hood with a sufficient shaded lens for the type of welding being performed.

5. Safety Belts and Lifelines

Whenever any associate is exposed to the hazard of falling six feet or more, he must wear a serviceable safety belt or harness and lifeline adequately secured to a fixed support. This will be so arranged that he cannot fall freely from a vertical distance more than three feet. This included any associate working on open steel, swing stages, suspended scaffolds, platforms without proper guarding, etc.

- When working on a swing stage or elevated device, the lifeline must be secured to a structure separate from the stage or elevating device.
- All safety belts, harnesses, lifelines and lanyards are to be inspected before use for fraying or other weak spots. Any defective item must be replaced before using.
- Safety belts and harness must be in good condition and the "D" ring must be placed in the back.
- Bolts, shackles, safety snap hooks, "D" rings and metal links which connect parts of the lifeline system to each other should be properly inspected and maintained at all times.
- Safety harness and lifelines are required on all work performed in confined spaces where an oxygen deficiency or toxic vapors may exist.

6. Back Support Harnesses

When any associate is required to move or lift any materials, dollys, forklifts, pallet jacks, back harnesses, and proper lifting techniques should be utilized. Proper lifting techniques are taught to all associates during training sessions and are as follows:

- Put on a back harness support
- Get a good footing on a solid surface
- Place one foot alongside and the other behind the object
- Squat down beside the object keeping your back as straight as possible
- Tilt the object and firmly grasp at the bottom center
- Draw the object close to your body and lift slowly by straightening your legs
- Do not lift more than you can carry. Get help with bulky or heavy loads.

4.2 SELECTION CRITERIA FOR PERSONAL PROTECTIVE EQUIPMENT (PPE)

Selection of the appropriate level of personal protection will be based on ambient air monitoring of particulate matter and lead concentrations. The PPE selection criteria is shown in the table below. The table identifies ranges of airborne lead concentrations for which a particular level of PPE is required (action levels)

AIRBORNE CONCENTRATION OF LEAD	ACTION REQUIRED	PROTECTION LEVEL
Less than 500 ug/m^3 (<10 x PEL)	None	Level C w\half-face respirator
500 ppm to 2500 ug/m^3 (<50 x PEL)	**	Level C (full)
2500 to 5000 ug/m^3 (<1000 x PEL)	**	Level B
50000 to 100,000 ug/m^3 (<2000 x PEL)	**	Level B
Greater than 100,000 ug/m^3	**	Level A
* In case of skin and/or eye irritation, upgrade to full face respirator ** Monitor with personnel pumps		

AIRBORNE CONCENTRATION OF CADMIUM	ACTION REQUIRED	PROTECTION LEVEL
Less than 50 ug/m^3 (<10 x PEL)	None	Level C w\half-face respirator
50 to 250 ug/m^3 (<50 x PEL)	**	Level C (full)
2.5 to 50 ug/m^3 (<250 x PEL)	**	Level B
Greater than 500 ug/m^3 (<1000 x PEL)	**	Level A
* In case of skin and/or eye irritation, upgrade to full face respirator ** Monitor with personnel pumps		

AIRBORNE CONCENTRATION OF ARSENIC	ACTION REQUIRED	PROTECTION LEVEL
Less than 100 ug/m^3	None	Level C w\half-face respirator
100 ug/m^3 to 500 ug/m^3	**	Level C (full)
500 ug/m^3 to 10,000 ug/m^3	**	Level B
Greater than 10,000 ug/m^3	**	Level A
* In case of skin and/or eye irritation, upgrade to full face respirator ** Monitor with personnel pumps		

TABLE 3
AIRBORNE CONTAMINANT ACTION LEVELS

PARAMETER	READING	ACTION
Flammable Vapors (Lower Explosive Limit)	<10% LEL	Normal Operations
	≥10% LEL	Stop work. Ventilate area. Investigate source of vapors.
Total Particulate (MIE MiniRAM)	<0.5 mg/m^3	Continue operations.
	≥0.5 mg/m^3	Stop operating. Wet down soils to control dusting.

4.3 AIR MONITORING

Air monitoring will be used to identify and quantify airborne levels of hazardous substances. During the initial stage of remedial activities, daily air monitoring for airborne particulates and lead concentrations will be performed. Only when recorded airborne contaminant levels are less than the upper range for the minimum PPE may the frequency of monitoring be reduced. Each frequency of monitoring reduction must meet this requirement. Periodic monitoring is required during on-site activities. The following chart summarizes the types of equipment, frequency of calibration, sampling frequency and location.

TYPE OF EQUIPMENT	PARAMETER TO BE MEASURED	SAMPLING FREQUENCY	SAMPLING LOCATION
High Volume Particulate samplers	Total lead	Daily during site activities	Four locations
Hand held Monitor (MiniRam)	particulate matter	Periodically during work day	Exclusion zone perimeter
Personnel air monitoring pumps	Total lead	As required by OSHA	On person operating equipment or HMT

Selection of the appropriate level of personal protective equipment will be based on ambient air monitoring. Half-face respirators will be used when possible due to the blocking of peripheral vision by full-face respirators. This vision handicap is an additional safety concern at sites where heavy equipment is in operation. Air monitoring action levels for choosing personal protective equipment are detailed in "Personal Protection"

If a situation arises where the potential for combustion of explosive gas generation exists, an explosivity meter will be used to measure combustible gas levels near the potential gas source. At 10-25 percent of the Lower Explosive Limit (LEL), the use of non-sparking tools will be implemented and flame and spark sources eliminated. At 25 percent of the LEL, the area will be evacuated and allowed to ventilate. When the combustible gas levels near the potential gas source are measured on an explosivity meter at safe levels, work will recommence.

4.4 PERSONNEL MONITORING

Monitors measuring concentrations of total dust shall be used to determine the proper selection of engineering controls, work practices and personal protective equipment necessary to assure an appropriate level of employee protection. The samples collected will be analyzed for lead. Personnel breathing zone monitoring will be performed as follows:

1.) Upon commencement of soil removal to identify any exposures over the PELs for each job classification.
2.) When a different type of operation is initiated, i.e., yard excavation versus excavation in an enclosed area.
3.) Frequently enough to characterize employee exposures that are likely to be the highest

exposures to respirable dust.

MinRAM aerosol monitoring will be conducted in conjunction with personnel breathing zone monitoring. This real time monitoring will be used as additional assurance that PELs are not being exceeded.

4.5 RADIOLOGICAL HAZARDS

The XRF portable analyzer contains a radiation source which may expose site personnel to radiological hazards. For this reason, use of the portable analyzer will be limited to those personnel who have been trained in its use. The analyzer will only be used in the manner and for the purpose for which it is designed.

4.6 DECONTAMINATION

Decontamination facilities for personnel and equipment will be provided by **ENTACT**. ENTACT personnel will decontaminate prior to leaving the site, and taking breaks. All personal protective equipment will be removed in the order of most contaminated to least contaminated equipment. **ENTACT** personnel will leave the **ENTACT** operations site in clean street clothing. Contaminated equipment will be placed into assigned containers for disposal or further decontamination. Equipment will be visually inspected and decontaminated with a high pressure water spray until no visible contamination remains on the equipment. The wash-water will be collected and channeled back to a treatment site. The following decontamination procedures will be implemented for these categories:

Decontamination of Personnel

Decontamination of personnel will be based on the standard decontamination procedures. The use of disposable sampling equipment where possible will limit decontamination procedures.

Protective clothing, boots, gloves, and respirators will be decontaminated prior to entering any support or off-site zone. This will be accomplished by thoroughly washing personnel materials with a soap and water solution. Personnel will be advised that all under protective clothing (i.e., underwear, socks, etc.) should be laundered separately from street clothing before re-wearing. If Protective clothing is breached and personal clothing becomes contaminated, the personal clothing will be disposed of.

Decontamination of Equipment

Decontamination of equipment (such as tools, containers, monitoring instruments, radios, clipboards, etc.) will be segregated and deposited on different plastic drop cloths of in plastic-lined containers placed in the Decontamination zones. The decontamination of heavier equipment will be carried out by high pressure water or steam on the decontamination pad.

4.7 EMERGENCY RESPONSE ACTION PLAN

Emergency conditions are considered to exist if any member of the field crew is involved in an accident or experiences any adverse effects of symptoms of exposure while on site; if a condition is discovered that suggests the existence of a situation more hazardous than anticipated; or if the evacuation signal is communicated by the Owner.

A communications system has been set up to inform all associates in the event of an emergency. All personnel are equipped with a personnel radio, and a sound horn will be present at the site at all times. Radios in conjunction with a sound horn will be used as the emergency alarm system. A constant tone with the sound horn blown into the personal radios will signal for all personnel to evacuate through the designated evacuation locations immediately. A series of three short beeps will be to signal all personnel to regroup at the designated location.

The Project Manager is responsible to assure that all associates are adequately instructed in the specifics of the emergency response action plan. All associates must either read the site health and safety plan, familiarizing themselves with this section, or be trained in the specifics covered by this section. Associates will be required to know the emergency contacts and phone numbers, and to know the emergency egress routes and know the location of the nearest phone.

4.8 PROCEDURES FOR EMERGENCY MEDICAL AND FIRST AID

In the event of personal injury, a site associate trained in first aid will administer treatment to the injured worker. If necessary, the injured worker will be transported to the nearest hospital. (For all areas, emergency arrangements will be made prior to the commencement of work at the project.) An ambulance will be provided if necessary. The supervisor is responsible for the completion of an Accident Report Form.

OSHA Subpart K, Medical Services and First Aid, states that an employer shall ensure that medical personnel are readily available for consultation if professional assistance is not in near proximity to the workplace, persons will be adequately trained to render first aid. ENTACT requests that at least one

person for every ten employees working is trained in first aid procedures and cardiopulmonary resuscitation (CPR).

ENTACT advises the following procedures in case of an accident, however these recommendations are not a substitution for First Aid Training:

1. Evaluate the situation and take immediate appropriate action. If necessary, remove the victim from a hazardous environment.
2. Make certain help has been obtained from an appropriate source.
3. Ascertain that the victim is breathing. If not, begin artificial respiration. Make sure the breathing passages are not blocked.
4. Stop bleeding. Follow proper decontamination procedures prior to removing a victim contaminated with hazardous substances. If the victim is not decontaminated, other people and areas could be contaminated.
5. Double check that help is on the way.
6. Communicate accurate information concerning details of the accident to medical personnel. It is very important that the medical personnel understand what type of chemicals that the victim has been exposed to. The **ENTACT** office is equipped with specific chemical information and first aid guidelines to assist you and the medical personnel. This information can be accessed and relayed to the hospital or medical personnel within minutes.

Order of Obtaining First Aid

If possible, designate another person to go for assistance while you stay with the victim.

1. Notify a physician, make him/her aware of the emergency and follow his advice regarding further first aid and transportation of the victim.
2. If it is apparent that the services of an ambulance are necessary, tell the telephone operator it is an emergency and ask him/her to connect you with the local ambulance service. If there is no ambulance service, telephone the nearest city, county, or state police.
3. In the telephone request to the doctor, police, or ambulance, be prepared to give:
   -Phone number calling from
   -Address and directions to the site
   -Describer the accident. number of victims and condition
   -Give your name

-Do not hang up until emergency personnel end the conversation

4. Stay at the site until the doctor or ambulance arrives.

Condition, Symptoms and Treatment

Stoppage of Breathing - Breathing stopped entirely

1. Check that breathing passages are not blocked.
2. Apply mouth to mouth method of artificial respiration at once.

Shock - Pale skin, body clammy and cold, pulse rapid and weak

1. Keep victim lying down.
2. Maintain normal body heat, but do not allow victim to become overheated.
3. If victim's face is pale, elevate feet slightly.

Bleeding - Blood flowing

1. Apply direct pressure over wound with cloth compress (sterile if possible).
2. If bleeding continues apply pressure at nearest pressure point above the bleeding.

Electrical Shock - Unconsciousness, burns may be present, may convulse

1. Survey the situation carefully. Make certain you are not the second victim.
2. If possible, turn power off.
3. If unable to turn power off move person from contact by moving live wire with a rope or dry board. If the victim remains in contact with the source of the electricity and must be moved use only your feet. By using your hands an electrical current is sent through your entire body including your heart and is far more serious than current through the legs. An electrical current through the lower extremities is rarely fatal.
4. Check breathing. Check pulse. If necessary, begin CPR. Do not stop life saving measures until medical personnel arrive.

Burns

1st degree - skin reddened - cover lightly with sterile dressing

2nd degree - skin blistered - cover lightly with sterile dressing

3rd degree - deep destruction of tissue usually with charring - cover lightly with sterile dressing and consult physician at once. Do not place grease or oil on any burn.

Fractures

Simple - pain and swelling, and/or deformed part.

Compound - broken bone plus break in skin and bleeding.

1. Immobilize fractured part.
2. Stop bleeding and dress wound.
3. Splint securely if patient has to be moved.

Spinal Injuries

Injury to the spinal cord should be suspected in any accident involving a fall or injury to the neck or back. Loss of sensation and/or movement,.Move the victim only if necessary. Attempt to keep the body aligned and the back and neck straight. Preferably, the victim should not be moved until an ambulance arrives with a special stretcher and trained personnel.

Choking - violent choking, alarmed expression, attempts at inhalation, discoloration in the face, neck, and hands, unconsciousness.

1. If the victim can cough, speak or breathe - DO NOT interfere by pounding on the victim's back.
2. If the victim can not respond or speak, first attempt to dislodge the object causing the choking by 3-4 quick blows between the shoulder blades with the heel of your hand.
3. If choking continues approach the victim from behind and place fisted hands below the rib cage and apply firm pressure in quick, sharp, upward blows to force air from the lungs.
4. If unconscious, turn victim's head to one side, apply same pressure outlined in Step 3.
5. Artificial respiration may be necessary for the unconscious victim after the object has been removed from the throat.

Sudden Illness

Heart Attack - Chest pain, shortness of breath, pale or bluish skin, shock.

Stroke - Loss of sensation and/or movement on one side of the body, pupils unequal, inability to talk, unconsciousness.

Convulsion - Rigidity of body muscles lasting from a few seconds to half a minute, bluish discoloration of face and lips.

Fainting - Unconsciousness

1. Check breathing. Check pulse. Begin CPR, if necessary.
2. Loosen tight clothing.
3. Keep normal body temperature.
4. In the case of convulsions - protect the victim from injury, but do not attempt to place objects in the victim's mouth.
5. Do not attempt to give an unconscious victim liquids.

Prevention of Heat Stress

1. Proper clothing - Loose fitting, light weight, light colored, and properly ventilated.
2. Hat - To prevent radiant heat exposure to the head and to shield the face from ultraviolet light.
3. Acclimatization - Heat disorders are more likely to occur at times when workers are unacclimatized to working in the heat. Most people require one week to adapt to a hot humid environment.
4. Work loads - During hot temperatures, work loads should be adjusted to each worker's acclimatization rate.
5. Body weight - Monitor your daily weight. A pint of water weighs one pound. If you have lost several pounds in one day, try to replace the amount of weight lost.
6. Heart rate and body temperature - While working in the heat your heart rate and body temperature are good measures of body stress.
7. Fluid intake - The most important measure of prevention adequate fluid intake during the work period.

Exposure to Hazardous Chemicals

The environmental industry is faced with the problem of handling mixtures of unknown substances. Speed is of prime importance in the prevention of injury from chemical exposure. It may not be possible to take the time to determine what particular chemical or combination of chemicals are responsible for the exposure. Even once a chemical is known it may require valuable time to refer to specific chemical exposure guidelines. If the "worst case" exposure guidelines are followed, then valuable time can be saved. In general, there are four ways that chemicals enter the body: inhalation, skin exposure, eye exposure, and ingestion.

Inhalation

1. Remove from hazardous area to fresh air.
2. If not breathing begin mouth to mouth respiration.

3. Give oxygen.
4. Call emergency services.
5. Identify chemicals.
6. Observation by physician for a 24 hour period depending on specific chemical.

Skin exposure

1. Remove contaminated clothing.
2. Wash under running water for 15 minutes.
3. Call emergency services.
4. Identify chemical
5. Observation by a physician if necessary.

Eye exposure

1. Wash eye for 15 minutes (remove contact lenses first).
2. Call emergency services.
3. Identify chemicals.
4. Evaluation and treatment by physician.

Ingestion

1. Identify chemical ingested.
2. Call poison control center or CHEMTREK 1-800-424-9300.
3. Follow actions given by center.
4. Seek follow-up medical attention if recommended by the center.

4.9 FIRE OR EXPLOSION

At the start of intrusive work, the Cleveland Fire Department will be notified and briefed about the potential hazards at the site. The Health and Safety Officer will be responsible for this notification. It will be the responsibility of the heavy equipment operators to have a fire extinguisher available on each heavy equipment vehicle operated.

In the event of a fire that cannot be controlled with available equipment, the local fire department will be summoned immediately by the Project Manager of his designee, who shall apprise them of the situation upon their arrival. If firefighters have to enter the Exclusion Zone, decontamination will be required upon leaving.

In the event of fire or explosion, or if vapor concentrations of explosive vapors or gasses approach or exceed 25 percent of the LEL as indicated by an explosion meter, personnel will evacuate the area immediately.

Fire Extinguisher Policy

ENTACT shall provide protection from fires in the form of portable fire extinguishers. This protection shall meet or exceed the requirements of NFPA-10-1984.

SECTION 5.0 TRAINING PROCEDURES

5.1 GENERAL SAFETY TRAINING PROCEDURES

ENTACT believes that safety is very much a state of mind. Therefore, the company's safety philosophy incorporates continuous training as a safeguard against accidents. As most accidents are caused by human error, managers and associates are trained to think in terms of safety first. All associates of **ENTACT** are required to attend a forty (40) hour safety training program before working at a job-site. Other safety training courses are offered and/or required, depending on the associate's position with **ENTACT**.

ENTACT currently maintains the following procedures and training:

1. Field safety inspections;
2. Foreman safety performance reviews;
3. Tool box safety meetings;
4. Weekly health and hygiene meetings;
5. Occupational Safety and Health Act of 1970 (OSHA) training, as set forth in Title 29 of the Code of Federal Regulations (CFR) Part 1910.120(e);
6. First aid training;
7. New associate orientation;
8. Incident reporting;
9. Toxic substance training; and
10. Asbestos abatement worker training for asbestos abatement associates.

The **ENTACT** training program assures compliance with safety rules, governmental regulations and other applicable procedures, safety rules and regulations. The **ENTACT** Training Program consists of the following instructional training:

1. All **ENTACT** personnel working on-site shall have received, at a minimum, forty (40) hours of training as set forth by OSHA in 29 CFR 1910.120 (e). Documentation verifying all training shall be kept on-site per associate. OSHA 29 CFR 1910.120(e) training includes the following:

    a. Basic chemistry of hazardous materials,
    b. Selection and use of personal protective clothing and equipment,

c. Health effects and symptoms recognition,
d. Decontamination procedures, and
e. Emergency response procedures.

2. **ENTACT** personnel shall receive continuing education and ongoing training in order that the employees maintain proficiency and thorough knowledge in the following areas:

a. The selection and use of Personal Protective Equipment (PPE), including a respirator fit test;
b. ENTACT's standard operations procedures per site;
c. The names and alternatives responsible for site safety and health;
d. Health, safety, and other hazards which may be present on-site, i.e. benzene;
e. Work practices which may be utilized by the associate to minimize risks from hazards;
f. Engineering controls, including equipment used on the site and site control measures.
g. Medical surveillance requirements, recognition of symptoms and signs that could indicate overexposure.
h. A complete plan for responses to emergency situations including the practicing of site evacuation routes.
i. Decontamination procedures.
j. Training for any specialized, non-typical or hazardous work to be completed at the site.

Supervisor Training

Supervisors of health and safety positions shall receive an additional eight (8) hours of safety training. Such additional training must meet the following conditions:

1. The training must be approved by the Project Manager and must be health and safety related.
2. The training must be accepted by the Project Manager and must meet the requirements of the OSHA 1910.120 standard which states, generally, that the supervisor must have more training than those he/she will supervise.

In addition, the supervisor must demonstrate to the Project Manager that he/she has the necessary work experience for a supervisory position.

5.2 TRAINING PROGRAM OUTLINE - OSHA 1910.120 40 HOUR HAZWOPER

DAY 1

I. Introduction
   A. Instructor's name and credentials
   B. Course overview
   C. Video No. 1

II. Review of applicable training regulations and regulators
   A. Department of Labor, Occupational Safety and Health Administration (OSHA)
      1. Occupational Safety and Health Act 29 CFR, General Safety Standards
      2. 29 CFR 1910.1200 Hazard Communication Standard (HAZCOM)
      3. 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER) Requirements
   B. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) 40 CFR Part 264.16 and 265.16, Training Requirements
   C. EPA Superfund Amendments and Reauthorization (SARA) 40 CFR Part 311, Worker Protection
   D. Department of Transportation (DOT) Hazardous Materials Transportation Act (HMTA)

III. Basic Chemistry and Physics of Hazardous Materials
   A. pH and corrosivity
   B. Flash Point
   C. Flammable limits (UEL, LEL)
   D. Specific Gravity
   E. Vapor density
   F. Vapor pressure
   G. Volatility
   H. Evaporation rate
   I. Chemical compatibility
   J. Reactivity
   K. Density
   L. Auto-ignition temperature
   M. Boiling and freezing point

N. Explosivity

O. Other properties of chemicals which affect its hazards

1. Organic vs. inorganic
2. Halogenated compounds
3. Toxic metals

Test I and Review

IV. Basic Toxicology (Chemical Hazards)

A. Definition of toxic vs hazardous

B. Toxicological terms

1. Acute
2. Chronic
3. Local
4. Systemic
5. LD50 and LC50

C. Exposure guidelines (handout)

1. TWA
2. TLV
3. PEL
4. STEL
5. Ceiling value
6. IDLH
7. Parts per million (ppm)
8. Milligrams per cubic meter (mg/m3)

D. Routes of entry (handout)

1. Absorption or contact with the skin
2. Ingestion
3. Inhalation
4. Entry through wounds

E. Classification of Toxic Materials

1. Irritants
2. Asphyxiants
3. Poisons

F. Video No. 2

G. Review of medical monitoring program

V. Physical hazards
   A. Heat stress (hyperthermia)
   B. Cold stress (hypothermia)
   C. Lifting
   D. Excavations
   E. Compressed gas
   F. Fire and explosion
   G. Electricity
   H. Noise - video No. 3
   I. Flying objects - video No. 4
   J. Radiation

Test II and Review

DAY 2

VI. Hazardous materials identification and assessment
   A. Material Safety Data Sheet (MSDS) handout
   B. Labeling and placarding systems
      1. National Fire Prevention Association (NFPA)
      2. Hazardous Materials Identification System (HMIS)
      3. DOT
   C. Manifests and other shipping documents
   D. DOT emergency response guidebook
   E. Other sources of information
      1. N. Irving SAX, Dangerous Properties of Hazardous Materials
      2. MERCK Index
      3. Chemical dictionary
      4. Chris sheets
      5. TOMES Plus Database System
   F. Video No. 5

Test III and Review

VII. Personal Protective Equipment (PPE)

A. Hazard assessment

1. Properties of chemical and physical hazard(s)
2. Degree of hazard(s)
3. Work function, duration, and probability of exposure

B. Equipment performance requirements - selection criteria

1. Chemical resistance
    a. Degradation
    b. Permeation
    c. Penetration
2. Strength
3. Flexibility
4. Temperature limits
5. Cleanability
6. Durability

C. Types of equipment and materials

1. Head protection
2. Eye and face protection
3. Ear protection
4. Foot protection
5. Hand protection
6. Body protection

D. EPA classifications of PPE

1. Level A
2. Level B
3. Level C
4. Level D

E. Care and maintenance of PPE

F. Video No. 6

Test IV and Review

DAY 3

VIII. Respiratory protection

A. Types of respiratory hazards

1. Dust
2. Fumes
3. Mists
4. Smoke
5. Vapors
6. Gases

B. Types of respiratory protective equipment

1. Air Purifying Respirators (APR)
    a. Particulate
2. Air supplying
    a. Self Contained Breathing Apparatus (SCBA)
    b. Supplied Air Breathing Apparatus (SABA)

C. Selection criteria

1. Protection factor (concentration of potential exposure)
2. Type of hazard
    a. Physical
    b. Chemical

D. Fit testing

E. Care and maintenance of respiratory protective equipment

F. Video No. 7

G. Video No. 8

Test V and Review

XI. Hands on demonstration of PPE - Dress-out procedures

DAY 4

X. Air monitoring

A. Purpose of air monitoring

B. Types of air monitoring equipment

C. Air monitoring methods and strategies - field monitoring vs. air sampling

XIII. Decontamination

A. Decon area layout

B. Decon methods

1. Physical
2. Chemical

C. Decon equipment

D. Decon procedures

E. Video No. 14

Test VIII and Review

DAY 5

XIV. Emergency Response

A. Video No. 15

B. Detection of releases (handout)

1. Mechanical and engineering controls and equipment
2. Non-mechanical methods

C. Site characterization and hazard assessment

1. Type and cause of incident
2. Identify material(s) involved and properties
3. Extent of release and damage or exposure/casualties
4. Immediate threats to human health and the environment
5. Evacuation routes and obstructions
6. Weather factors

D. Communications - chain of command and assignments

E. Site security and control

1. Public and private access
2. Media relations

F. Types of containment equipment

G. Methods of containment and hazard mitigation

1. On land
2. On water
3. In the air

H. Video No. 16

Final Test and Review

APPENDIX A

EMERGENCY TELEPHONE NUMBERS

APPENDIX A

Cleveland, Ohio

Emergency Response Telephone Numbers

FIRE DEPARTMENT

Emergency 911

Administrative ..... (216) 664-6350

POLICE DEPARTMENT

Emergency 911

Administrative ..... (216) 621-1234

AMBULANCE

Emergency 911

HOSPITAL ..... See Appendix B

ENVIRONMENTAL PROTECTION AGENCY

24 hour Spill Reporting 1-800-438-2474

Response Information 1-800-438-2474

Hazardous Waste Hotline 1-800-424-9346

OTHER IMPORTANT NUMBERS

NATIONAL RESPONSE CENTER 1-800-424-8802

NATIONAL CHEMTREC (24 hr) 1-800-424-9300

NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY & HEALTH 202-639-7960

CLEVELAND HAZARDOUS MATERIAL SPILL..... 216-771-1365

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Health Standards	202-639-7960
Safe Drinking Water	1-800-426-4791
Substance Identification	1-800-848-6538

CHEMICAL EMERGENCY PREPAREDNESS, CERCLA	1-800-535-0202
POISON INFORMATION CENTER	313-745-5711
US DEPARTMENT OF TRANSPORTATION	1-202-366-4488

APPENDIX B

LOCAL HOSPITAL INFORMATION

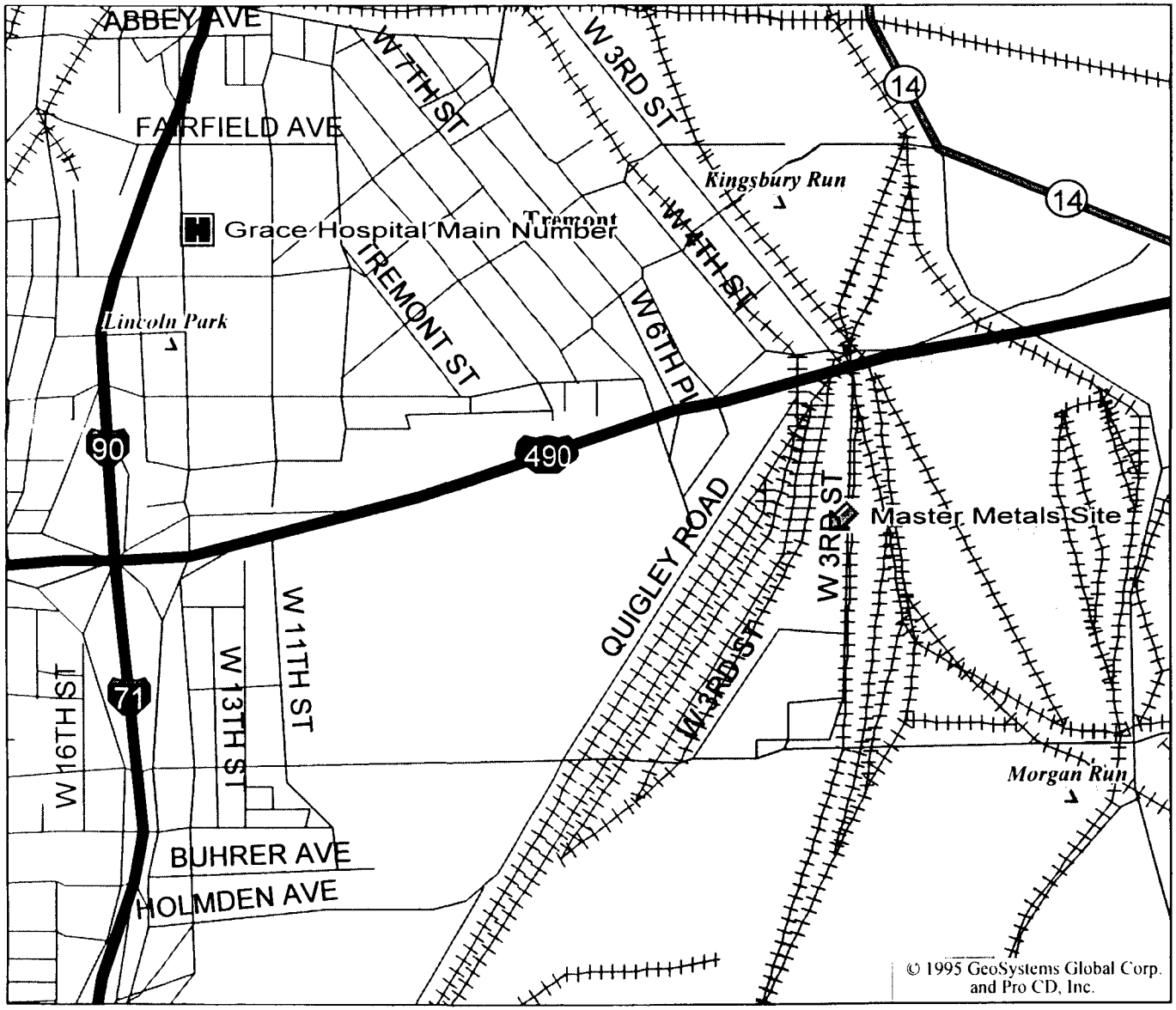
APPENDIX B

LOCAL HOSPITAL
ADDRESSES AND PHONE NUMBERS

Grace Hospital 216-687-1500
2307 W. 14th Street
Cleveland, Ohio 44113

(Map of Nearest Hospital on Following Figure)

Master Metals Site - Hospital Route



Populated Area
Water
Railroad
Minor Road
Secondary Road
Primary Road
Point of Interest

Grace Hospital
2307 W. 14th Street
Cleveland, Ohio 44113
(216) 687-1500

ProCD Select Street Atlas

APPENDIX C

PERSONAL PROTECTIVE EQUIPMENT

APPENDIX C

PERSONNEL PROTECTIVE EQUIPMENT: INTRODUCTION TO RESPIRATORY PROTECTION

INTRODUCTION

The respiratory system is able to tolerate exposures to toxic gases, vapors, and particulates, but only to a limited degree. Some chemicals can impair or destroy portions of the respiratory tract, or they may be absorbed directly into the bloodstream from the lungs. Chemicals that enter the blood may eventually affect the function of other organs and tissues. The respiratory system can be protected by avoiding or minimizing exposure to harmful substances. Engineering controls such as ventilation help decrease exposure. When these methods are not feasible respirators may provide protection. Certain respirators can filter gases, vapors, and particulates in the ambient atmosphere, other respirators are available which can supply clean breathing air to the wearer.

The use of respirators is regulated by the Occupational Safety and Health Administration (OSHA). Regulations stipulate the use of approved respirators, proper selection, and individual fitting of respirator users. This unit discusses the topics necessary to ensure quality respiratory protection.

THE RESPIRATORY SYSTEM - STRUCTURE AND FUNCTION

Inhalation

When air is inhaled, the chest muscles and diaphragm contract, lifting the rib cage and dropping the diaphragm. These actions enlarge the chest cavity, resulting in lung expansion with inhalation.

Normally, air is pulled through the nose, but it also can be inhaled through the mouth. The nasal passages are very narrow and divided which forces the air to travel a turbulent path. Particulate matter is impacted, and soluble particulates, and gases are absorbed on the walls of the passages. Still, some contaminants escape this initial deposition and penetrate further into the respiratory system.

The inhaled air passes through the pharynx and enters the trachea at the larynx. The pharynx is the

common part for the passage of air and food. The trachea, commonly called the windpipe, divides into two bronchi, one leading to each lung. Further divisions of the bronchus are named bronchioles. Collectively the passages are called conducting tubes because they carry air to the sites where oxygen and carbon dioxide are exchanged. Lining the conducting tubes are mucus and cilia. Contaminants are caught in the mucous, swept up to the esophagus by the cilia, and swallowed. In this way, the respiratory system rids itself of some contaminants in inhaled air. At the end of the bronchioles are alveoli, sacs with very thin walls, filled with bundles of capillaries. Here oxygen in the inhaled air is diffused into the bloodstream and carbon dioxide is diffused out to be exhaled.

Exhalation

When air is exhaled, the chest muscles and diaphragm are expanded, decreasing the size of the chest cavity. This forces air out of the lungs back along the same route. A relaxed person breathes about 10 liters of air per minute. During brisk activity, the volume can increase to over 75 liters per minute. In such a situation, the respiratory system must handle a very large volume of air.

RESPIRATORY HAZARDS

The normal atmosphere consists of 78% nitrogen, 21% oxygen, 0.9% inert gases and 0.04% carbon dioxide. An atmosphere containing toxic contaminants, even at very low concentrations, could be a hazard to the lungs and body. A concentration large enough to decrease the percentage of oxygen in the air can lead to asphyxiation, even if the contaminant is an inert gas.

Oxygen Deficiency

The body requires oxygen to live. If the oxygen concentration decreases, the body reacts in various ways. Death occurs rapidly when the concentration decreases to 6%.

PHYSIOLOGICAL EFFECT OF OXYGEN DEFICIENCY	
Percent Oxygen	**Effects**
21-16	Nothing abnormal.
16-12	Loss of peripheral vision, increased breathing volume, accelerated heartbeat, impaired attention and thinking, impaired coordination.
12-10	Very faulty judgement, very poor muscular coordination, muscular exertion causes fatigue that may cause permanent heart damage, intermittent respiration.
10-6	Nausea, vomiting, inability to perform vigorous movement, or loss of all movement, unconsciousness, followed by death.
<6	Spasmatic breathing, convulsive movements, death in minutes.

Physiological effects of oxygen deficiency are not apparent until the concentration decreases to 16%. The various regulations and standards dealing with respirator use recommended that concentrations ranging from 16-19.5% be considered indicative of an oxygen deficiency. Such numbers take into account individual physiological responses, errors in measurement, and other safety considerations. In hazardous materials response operations 19.5% oxygen in air is considered the lowest "safe" working concentration. Below 19.5% available oxygen, a supplied air respirator must be used.

Aerosols

Aerosols is a term used to describe fine particulates (solid or liquid) suspended in air. Particulates ranging in diameter from 5 to 30 microns are deposited in the nasal and pharyngeal passages. The trachea and smaller conducting tubes collect particulates 1-5 microns in diameter. For particulates to diffuse from the bronchioles into alveoli they must be less than 0.5 microns in diameter. Larger particles do reach the alveoli due to gravity. The smaller particulates may never be deposited in the alveoli and so may diffuse back into the conducting tubes to be exhaled.

Aerosols can be classified in two ways: by their physical form and origin and by the physiological effect on the body.

Physical Classification Examples:

Mechanical dispersoid: liquid or solid particle mechanically produced.

Condensation dispersoid: liquid or solid particle often produced by combustion.

Spray: visible liquid mechanical dispersoid.

Fume: extremely small solid condensation dispersoid.

Mist: liquid condensation dispersoid.

Fog: mist dense enough to obscure vision.

Smoke: liquid or solid organic particles resulting from incomplete combustion.

Smog: mixture of smoke and fog.

Physiological Classification Examples:

Nuisance: no lung injury but proper lung functions inhibited.

Inert pulmonary reaction causing: non-specific reaction.

Pulmonary fibrosis causing: effects ranging from nodule production in lungs to Serious diseases such as asbestos.

Chemical irritation: irritation, inflammation, or ulceration of lung tissue.

Systemic poison: diseases in other parts of the body.

Allergy-producing: causing allergic hyper sensitivity reactions

Gaseous Contaminants

Gases and vapors are fitted to some degree on their trip through the respiratory tract. Soluble gases and vapors are absorbed by the conducting tubes in route to the alveoli. Not all will be absorbed so that along with insoluble gases, they finally diffuse into the alveoli when they can be directly absorbed into the bloodstream. Gaseous contaminants can be classified as chemical and physiological hazards.

Chemical

Acidic: acids or react with water to form acids.

Alkaline: bases or react with water to form bases.

Organic: compounds which contain carbon; may range from methane to chlorinated organic solvents.

Organometallic: organic compounds containing metals.

Hydrides: compound in which hydrogen is bonded to another metal.

Inert: no chemical reactivity.

Physiological

Irritants: corrosive substances which injure and inflame tissue.

Asphyxiants: substances which displace oxygen or prevent the use of oxygen in the body.

Anesthetics: substances which depress the central nervous system, causing a loss of sensation or intoxication.

Systemic poisons: substances which can cause disease in various organ systems.

RESPIRATORY PROTECTION DEVICES

The basic function of a respirator is to reduce the risk of respiratory injury due to breathing airborne contaminants. A respirator provides protection by removing the contaminants from ambient air by supplying the wearer with an alternate source of clean breathing air.

All respiratory apparatus are composed of two main parts: (1) the device which supplies or purifies air, and (2) the facepiece which covers the nose and mouth and seals out contaminants. The first component defines what class of respirator the device is; the second determines the relative measure of protection afforded by that respirator.

Classes of Respirators

Respirators are divided into two major classifications according to their mode of operation:

APR's Air Purifying Respirators (APR's) remove contaminants by passing the breathing air through a purifying element. There are a wide variety of APR's available to protect against specific contaminants, but they all fall into two subclasses: (1) particulate APR's which employ a mechanical filter element, and (2) gas and vapor APR's that utilize chemical sorbents contained in a cartridge or canister.

It is important to realize that there are limitations on the applications of APR's. These devices are specific for certain types of contaminants, so the identity of the hazardous agent must be known. There are maximum concentration limits; this requires a knowledge

of the ambient concentration of the contaminant, as well as the Maximum Use Limit (MUL) of the respirator. Since APR's only clean the air, the ambient concentration of oxygen must be sufficient (>19.5%) for the user.

ASR's Atmosphere Supplying Respirators (ASR's) provide a substitute source of clean breathing air. The breathing air is supplied to the worker from either a stationary source through a long hose, or from a portable container. The first type are called supplied-air respirators (SCBA). These devices can be used regardless of the type of airborne contaminant or oxygen concentration. However, the contaminant concentration limits vary for the different types of ASR's and the wearer must be aware of the limitations of his/her respirator.

Respiratory Protection

The protection provided the respirator wearer is a function of how well the facepiece fits. No matter how efficient the purifying element of how clean the supplied air, there is little protection afforded if the respirator mask does not provide a leak-free facepiece-to-face seal. Facepieces are available in three basic configurations which relate to their protective capacity.

Quarter-Mask (Type B Half-Mask) fits over the bridge of the nose, along the cheek, and across the top of the chin. The headbands which hold the respirator in place are attached at two or four places of the mask. Limited protection is expected because the respirator can be easily dislodged, creating a breach in the seal.

Half-Mask (Type A Half-Mask) fits over the bridge of the nose, along the cheek, and under the chin. Headbands have a four-point suspension. Because they maintain a better seal and are less likely to be dislodged, half-masks give greater protection than quarter-masks.

Full-Facepiece fits across the forehead, down over the temples and cheeks, and under the chin. They typically have a head harness with a five or six-point suspension. These masks give the greatest protection because they are held in place more securely and because it is easier to maintain a good seal along the forehead than its is across the top of the nose. An added benefit is the eye protection from the clear lens in the full-facepiece.

Not all respirators fit everyone, so each individual must find out which manufacturer's masks he/she can properly wear. At best, any given respirator will fit 60% of the working population. But with the large

number of respirators available, at least one type should be found to fit an individual.

The use of respirators is prohibited when conditions prevent a good facepiece-to-face seal. Some examples of these conditions are facial hair, skullcaps, long hair, make-up, and temple pieces on eyeglasses. Because maintaining a leak-free seal id so important, personnel required to wear respirators must successfully pass a fit-test designed to check the integrity of the seal. There are two types of fit-tests: qualitative and quantitative. The quantitative test is an analytical determination of the concentration of a test agent inside the facepiece compared to that outside the mask. This concentration ratio is called the Assigned Protection Factor (APF) and is a measure of the relative protection offered by a respirator. For example, if the ambient concentration of the test agent is 1000 and the concentration inside the mask is 10ppm, the respirator gives the tested individual an APF of 100.

$$APF = \frac{\text{Concentration outside the mask}}{\text{Concentration inside the mask}}$$

Because quantitative tests are expensive and tedious, qualitative tests are most often performed to check respirator fit. A qualitative fit-test is not an analytical measurement. It is a subjective test where an irritant or aroma is used to determine if there is a good facepiece-to-face seal. If the test subject does not respond to the test agent, he/she can wear the tested respirator with the APF for that type of mask. A Protection Factor is used to determine the Maximum Use Limit (MUL) of a successfully fir-tested respirator. The MUL is the highest concentration, not exceeding IDLH concentration, of a specific contaminant in which a respirator can be worn:

$$MUL = APF \times TLV$$

For example, if a concentration has a TLV-TWA of 10ppm, then the MUL for any half-mask respirator is 100ppm; the MUL for a full-facepiece APR or demand SCBA is 1000ppm. If the ambient concentration is greater than 1000ppm, then pressure demand SCBA is required.

Fit testing and Assigned Protection Factors are only two of the several considerations for selecting the proper respirator.

RESPIRATOR ASSIGNED PROTECTION FACTORS*		
Type of Respirator		**NIOSH APF**
Air-purifying	quarter-mask	5
	half-mask	10
Air-line	quarter-mask	10
	half-mask	10
Hose mask	full facepiece	10
SCBA, demand	quarter-mask	10
	half-mask	10
Air-purifying	full facepiece	50
Air-line, demand	full face piece	50
SCBA, demand	full facepiece	50
Air-line, pressure-demand with escape provision	full facepiece (no test required)	10,000
SCBA, pressure demand or positive pressure	full facepiece (no test required)	10,000
* For more detailed information consult "Respirator Protection Factors" in ANSI Z88.2-1980.		

RESPIRATOR USE AND SELECTION

User Requirements

The health of a respirator wearer is based on how the respirator is used. The American National Standards Institute (ANSI) has prepared the "American National Standard Practices for Respiratory Protection". The latest version Z88.2-1980, was issued in 1980 as a voluntary standard. It addresses all phases of respirator use and is highly recommended.

The Occupational Safety and Health Administration, in 29 CFR 1910.134 Section B, as well as Z88.2-1980, requires a "minimal acceptable program" to ensure sound respiratory protection practices. The requirements for a minimal acceptable program are quoted from 29 CFR 1910.134 as follows:

> Written standard operating procedures governing the selection and use of respirators shall be established.

Respirators shall be selected on the basis of the hazards to which the worker is exposed.

The user shall be instructed and trained in the proper use of respirators and their limitations. Respirators shall be regularly cleaned and disinfected. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

Respirators shall be stored in a convenient, clean, and sanitary location.

Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically.

Approved respirator shall be used. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it is designed in accordance with approvals established by the National Institute for Occupational Safety and Health (NIOSH).

Selection

In general ANSI Z88.2-1980 state that the selection of the proper approved respirator depends upon:

The nature of the hazard.

The characteristics of the hazardous operation or process.

The location of the hazardous area with respect to a safe area having respirable air.

The period of time for which respiratory protection may be needed.

The activity of workers in the hazardous area.

The physical characteristics, functional capabilities, and limitations of respirators of various types.

The respirator/protection factors and respirator fit.

All these criteria must be considered in the selection of a respirator. The joint NIOSH/OSHA Standards Completion Respirator Committee devised a "Respirator Decision Logic" based on the above criteria.

RESPIRATOR APPROVAL

As stated above, OSHA regulations require the use of approved respirators. Respirators are tested by NIOSH Testing Laboratory in accordance with the requirements of 30 CFR Part 11 and are jointly approved by the Mine Safety and Health Administration (MSHA). An MSHA/NIOSH approval indicates that the respirator in use is identical to the one submitted for the original approval. If a manufacturer changes any part of the respirator without resubmitting it to the NIOSH Testing Lab, the approval is invalid and will be rescinded. This is intended to protect the respirator by the user invalidates the respirator approval and all the guarantees understood with the approval.

RESPIRATOR CARE AND CLEANING

Once a respirator has been used it must be cleaned. All detachable parts such as straps, valves, and gaskets are removed. Cartridges cannot be cleaned. They can be used again if their service life has not been exhausted and they are stored properly. The facepiece and other parts can be washed separately in sanitizer solution. The parts should go through two water rinses and be left to air dry. When dry, the parts are reassembled and the respirator is put in a clean plastic bag and stored away from extreme temperatures.

PERSONNEL PROTECTIVE EQUIPMENT:
AIR-PURIFYING RESPIRATORS

INTRODUCTION

Respiratory protection must be used when the concentration of a substance in the ambient atmosphere exceeds a personal exposure limit. Several exposure limits used to determine the need for respiratory protection. In order of precedence, these are the OSHA Permissible Exposure Limits (PELs), NIOSH Recommended Exposure Limits (RELs), and the ACGIH Threshold Limit Values (TLVs). If none of these are available other published data may be used.

Air-purifying respirators may be used only if all of the following requirements are met:

The identity and concentration of the contaminant are known.

The ambient concentration of a contaminant is below the immediately Dangerous to Life and Health (IDLH) concentration.

The oxygen content in the atmosphere is greater than 19.5%.

The respirator assembly is approved for protection against the specific concentration of a contaminant.

There is periodic monitoring of the work area.

The respirator assembly has been successfully fit tested on the user.

RESPIRATOR CONSTRUCTION

An air-purifying respirator (APR) consists of a facepiece and a purifying element. In some APR designs there are combined in a single unit, more often they are separate components. There are several basic designs of air-purifying respirators.

Disposable Dust Respirators

These are generally constructed using cloth or paper as the filter element. Most respirators of this design are not approved.

Emergency Escape Mouthbit Respirators

Mouthbit respirators are approved for escape use only. The mouthpiece containing the cartridge element is held in place by the teeth and a clamp is used to seal the nostrils.

Quarter-Mask respirators (Type B Half-Mask)

The quarter-mask respirator is used for dusts. The facepiece fits from the top of the nose to the top of the chin.

Half-Mask Respirators (Type A Half-Mask)

The half-mask respirator has approved cartridges for pesticides, organic vapors, dusts, mists, fumes, and several other combinations. A half-mask respirator fits from above the nose to under the chin.

Full-Face Respirators

A full-face respirator provides full face protection, including the eyes. It has a much higher APF than the half- and quarter-masks. The full-face mask may be used with a wide variety of filtration media. This type of respirator may be used with cheek-mounted cartridges, chin-mounted cartridges, chin-mounted canisters, or chest/back-mounted canisters.

Powered Air-Purifying Respirators

Powered air-purifying respirators utilize pumps or fans to force air through the purifying elements. This eliminates breathing resistance and may help to maintain positive pressure in the facepiece. Powered air purifying respirators are available in quarter, half, and full face designs.

FACEPIECE

The facepiece is the means of sealing the respirator assembly to the user's face. The facepiece consists of the lens, mask suspension, and a means of attaching the filtration elements. Each respirator manufacturer utilized different means for attaching components to the facepiece. This prevents mixing parts from different manufacturers which would void a respirator's approval. The full-facepiece provides eye protection, is easier to fit, and has Assigned Protection Factor greater than the half-mask.

AIR-PURIFYING ELEMENTS

Respiratory hazards can be broken down into two classes: particulates and vapors/gases. Particulates are filtered by mechanical means, while vapors and gases are removed by sorbents that react chemically with them. Respirators using a combination of mechanical filter and chemical sorbent will effectively remove both hazards.

Particulate-Removing Filters

Particulates can occur as dusts, fumes, or mists. The particle size can range from macroscopic to microscopic, and their toxicological effects can be severe or innocuous. The hazard posed by a particulate can be determined by its exposure limit (EL).

Most particulate filters are only approved for dusts and/or mists with ELs equal to or greater than 0.05 mg/m^3. These dusts are considered to product pneumoconiosis and fibrosis. Such filters have an efficiency of 80-90% for 0.6 micrometer particles.

Respirators approved for fumes are more efficient, removing 90-99% for 0.6 micrometer particles. This type of respirator is approved for dusts, fumes, and mists with ELs equal to or greater than 0.05 mg/m^3.

Finally there is a high efficiency filter, which is 99.97% effective against particles 0.3 microns in diameter. It is approved for dusts, mists, and fumes with an EL less than 0.05 mg/m^3.

Mechanical filters load with particulates as they are used. As they do, they become more efficient, but also harder to breathe through. When a mechanical filter becomes difficult to breathe through it should be replaced.

Gas and Vapor-Removing Cartridges and Canisters

When selecting a gas- or vapor-removing element, it must be chosen for protection against a specific type of contaminant. Some of the commonly employed types of chemical cartridges and canisters and their OSHA-required color coding are listed in the 29 CFR 1910.135. These gas- or vapor-elements are available in different styles. The physical differences are size and means of attachment. The smallest elements are cartridges which contain 50-200 cm^3 of sorbent and attach directly to the facepiece, usually in pairs. Chin canisters have a volume of 250-500 cm^3 and are attached to a full-facepiece. Gas-masks contain 1000-2000 cm^3 and are attached by a harness to the wearer's front or back and connected to the full-facepiece by a breathing hose. The difference in applications is the Maximum Use Concentration for which the cartridge or canister can be used in accordance with its NIOSH/OSHA approval.

Each sorbent has a finite capacity for removing contaminants and when this limit is reached the cartridge or canister is said to be saturated. The length of time a cartridge or canister will effectively absorb the contaminate is known as the service life of the element. Service life if dependent on several factors: the berthing rate of the wearer; contaminant concentration; and sorption efficiency.

A warning property is used as a sign that a canister or cartridge in use is beginning to lose its effectiveness. A warning property can be detected as an odor, taste, or irritation. At the first signal the respirator should be exchanged for a new one. The ability to rely on the senses to detect the sorption efficiency depends upon the substance concentration. Some substances, such as toluene, are easy to detect, but others, such as dimethylformamide, have and odor threshold of 100ppm with a EL of 10ppm. Adequate warning properties are discussed in more detail in NIOSH/OSHA Respirator Decision Logic.

REQUIREMENTS FOR RESPIRATOR USE

The use of an air-purifying respirator is contingent upon a number of criteria. If the conditions spelled-out in this section can not be met, then use of an APR is prohibited.

Oxygen Content

The normal atmosphere contains approximately 21% oxygen. Without regard to contaminants, the atmosphere must contain a minimum of 19.5% oxygen to permit the use of air-purifying respirators. Below 19.5% oxygen, atmosphere supplying respirators must be used instead.

Identification of Contaminants

It is absolutely imperative that the contaminant(s) be known so that;

the toxic effects of inhaling the contaminant can be determined;

appropriate particulate filters or cartridges/canisters can be chosen;

it can be determined that adequate warning properties exist for the contaminant;

the appropriate facepiece be selected

Known Contaminant Concentration

The maximum concentration depends on the respirator;

concentration must not exceed IDLH;

the Maximum Use Limit of the respirator cannot be exceeded;

the Maximum Use Concentration of a particular type and size cartridge or canister must not be surpassed;

expected service life should be determined, if possible.

PERSONNEL PROTECTIVE EQUIPMENT:
SELF-CONTAINED BREATHING APPARATUS

INTRODUCTION

Respiratory apparatus must frequently be used during response to hazardous materials incidents. If the contaminant is unknown or the requirements for using air-purifying respirators cannot be met, then an atmosphere supplying respirator is required. Several types of atmosphere supplying devices are available:

Oxygen-generating

One of the oldest respirators is the oxygen-generating respirator, which utilizes a canister of potassium superoxide. The chemical reacts with water vapor to produce oxygen which replenishes the wearer's exhaled breath. Exhaled CO_2 is removed by a scrubber device containing LIOH. This reoxygenated air is then returned to the wearer. Oxygen-generating respirators are used by the military in mines, but they are not usually used in hazardous materials applications because of the chemical reaction taking place within the respirator itself.

Hose Mask

This type of respirator consists of a facepiece attached to a large diameter hose which transports clean air from a remote area. In units where the wearer breathes the air in, the hose lines can go up to 75 feet. With powered units the hose length can vary from 50 to 250 feet.

Airline Respirator

The airline respirator is similar to the hose mask, except that breathing grade air is delivered to the wearer under pressure; either from a compressor or a bank of cylinders. The air may flow continuously, or it may be delivered on demand. The air source must not be depletable, and no more than 300 feet of airline is allowed.

Self-Contained Breathing Apparatus

The self-contained breathing apparatus (SCBA) consists of a facepiece and regulator mechanism connected to a cylinder of compressed air or oxygen carried by the wearer.

The self-contained breathing apparatus (SCBA) is generally used because it allows the wearer to work without being confined by a hose or airline. The wearer of the SCBA depends on it to supply clean breathing air.

If the wearer is not properly trained to wear the SCBA or it is not properly cared for, then it may fail to provide the protection expected.

The user should be completely familiar with the SCBA being worn. Checkout procedures have been developed for inspecting an SCBA prior to use, allowing the user to recognize potential problems. An individual who checks out the unit is more comfortable and confident wearing it.

There are two types of apparatus: closed-circuit (compressed oxygen) and open-circuit (compressed air). SCBA's may operate in one of two modes, demand or pressure demand. The length of time an SCBA operates is based on air supply. The units available operate from 5 minutes to over 4 hours.

Pressure demand is the only approved type of open circuit SCBA for use in hazardous environments by the EPA and NFPA. The pressure-demand SCBA's are most widely used because they offer more protection.

MODES OF OPERATION

Demand

In the demand mode, a negative pressure is created inside the facepiece and breathing tubes when the wearer inhales. This negative pressure draws down a diaphragm in the regular SCBA. The diaphragm depresses and opens the admission valve, allowing air to be inhaled. As long as the negative pressure remains, air flows to the facepiece. The problem with the demand operation is that the wearer can inhale contaminated air through any gaps in the facepiece-to-face sealing surface.

Pressure-Demand

An SCBA operating in the pressure-demand mode maintains a positive pressure inside the facepiece at all times. The system is designed so that the admission valve remains open until enough pressure is built up to close it. The pressure builds up because air is prevented from leaving the system until the wearer exhales. Less pressure is required to close the admission valve than is required to open the spring-loaded exhalation valve.

At all times, the pressure in the facepiece is greater than the ambient pressure outside the facepiece. If any leakage occurs, it is outward from the facepiece. Because of this, the pressure-demand SCBA has been assigned a Protection Factor of 10,000.

TYPES OF APPARATUS

Closed-Circuit

The closed circuit SCBA, commonly called the rebreather, was developed especially for oxygen-deficient situations. Because it recycles exhaled breath and carries only a small oxygen supply, the service time can be considerably greater than an open-circuit device, which must carry all of the user's breathing air. The air for breathing is mixed in a flexible breathing bag. This air is inhaled, deflating the breathing bag. The deflation depresses the admission valve, allowing the oxygen to enter the bag. There it mixes with exhaled breath, from which carbon dioxide has just been removed by passage through a CO_2 scrubber.

Most rebreathers operate in the demand mode. Several rebreathers are designed to provide a positive pressure in the facepiece. Rebreathers designed to operate in the positive pressure mode can be approved strictly as closed-circuit apparatus. Rebreathers use either compressed oxygen or liquid oxygen. To assure the quality of the air to be breathed, the oxygen must be at least medical grade breathing oxygen which meets requirements set by the "U.S. Pharmacopeia".

Open-Circuit

The open-circuit SCBA requires a supply of compressed breathing air. The user simply inhales and exhales. The exhaled air is exhausted from the system. Because the air is not recycled, the wearer must carry the full air supply, which limits a unit to the amount of air that the wearer can easily carry. Available SCBA's can last from 5 to 60 minutes. Units which have 5 to 15 minute air suppliers are only applicable

to escape situations.

The air used in open-circuit apparatus must meet the requirements in the Compressed Gas Association's Pamphlet G-7.1, which calls for Grade D air, contains 19.5 to 23.5% oxygen and the balance being mostly nitrogen. Air quality can be checked using an oxygen meter, carbon monoxide meter and detector tubes.

COMPONENTS OF A TYPICAL OPEN-CIRCUIT PRESSURE DEMAND SCBA

Cylinder

Compressed air is considered a hazardous material. For this reason, any cylinder used with a SCBA must meet the DOT's "General Requirements for Shipments and Packaging" and "Shipping Container Specifications". A hydrostatic test must be performed on a cylinder at regular intervals: for steel and aluminum cylinders, every 5 years; for composite cylinders, every 3 years. Composite cylinders are relatively new, designed with fiberglass. Composite cylinders have a DOT exemption because there are not set construction requirements at this time. The construction technology reduces the weight of the cylinder and thereby the overall weight of the SCBA.

Air volume of 45 cubic feet of Grade D air at a pressure of 2,216 psi is needed for a 30-minute supply. If the cylinder is overfilled, a rupture disc releases the pressure. The rupture disc is located at the cylinder valve, along with a cylinder pressure gauge accurate within +-5%. Because the gauge is exposed and subject to abuse, it should be used only for judging if the cylinder is full, and not for monitoring air supply to the wearer.

High Pressure Hose

The high-pressure hose connects the cylinder and the regulator. The hose should be connected to the cylinder only by hand, never with a wrench. An O-ring inside the connector assures a good seal.

Alarm

A low-pressure warning alarm is located near the connection to the cylinder. This alarm sounds to alert the wearer that only 20-25% of the full cylinder air supply is available for retreat, usually 5 to 8 minutes.

Regulator Assembly

Air travels from the cylinder through the high-pressure hose to the regulator. There it can travel one of two paths. If the by-pass valve is opened, air travels directly through the breathing hose into the facepiece. If the mainline valve is opened, air passes through the regulator and is controlled by that mechanism. Also at the regulator is another pressure gauge which also must be accurate +-5%. Because it is visible and well protected, this gauge should be used to monitor the air supply.

Under normal conditions, the bypass valve is closed and the mainline valve opened so air can enter the regulator. Once in the regulator, the air pressure is reduced from the actual cylinder pressure to approximately 50-100 psi by the reducing mechanism. A pressure relief valve is located after the pressure reducer for safety should the pressure reducer malfunction. The airflow rate to meet NIOSH standards must meet or exceed 40 liters/minute. NFPA 1981 states the airflow rate must meet or exceed 100 liters/minute.

Breathing Hose and Facepiece

The breathing hose connects the regulator to the facepiece. Rubber gaskets at both ends provide tight seals. The hose is usually constructed of neoprene and is corrugated to allow stretching. Above the point in the mask where the hose is connected, is a one way check valve. This valve allows air to be drawn from the hose when the wearer inhales but prevents exhaled air from entering the breathing hose. If the check valve is not in pace, the exhaled air may not be completely exhausted from the facepiece.

The facepiece is normally constructed of neoprene, but sometimes silicone rubber. The visor lens is made of polycarbonate or other clear, shatter proof, and chemically resistant material. At the bottom of the facepiece is an exhalation valve. Some masks include an air-tight speaking diaphragm, which facilitates communications while preventing contaminated air from entering.

Back Pack and Harness

A back pack and harness support the cylinder and regulator, allowing the user to move freely. Weight should be supported by the hips not the shoulders.

INSPECTION AND CHECKOUT

The SCBA must be inspected according to manufacturers as well as 29 CFR recommendations. In addition, the SCBA should be checked out immediately prior to use. Checkout and inspection procedures should be followed closely to assure safe operation of the unit.

PERSONNEL PROTECTIVE EQUIPMENT:
RESPIRATOR FIT-TESTING AND CARE

INTRODUCTION

All users of demand-type respiratory protection devices are fit tested to ensure a proper facepiece-to-face seal. Various types of smell detection oils may be used in this procedures.

METHODS

A. Method No 1. - Swab or Brush (Organic Vapor)

- Use only facepieces equipped with organic vapor cartridges.

- Perform the test in an area with no noticeable air movement.

- Saturate a tissue, cloth or brush with the smell oil.

- Prior to testing, expose the employee to a very low concentration of smell oil to assure that he/she can detect the odor.

- After employee dons the respirator, tester inspects the facepiece-to-face seal. If seal obviously leaks, test ends and mask is recorded as unsatisfactory. If employee is uncomfortable, test ends.

- Move the smell oil slowly around entire sealing surface of the respirator at a distance of 3 to 6 inches. Perform first with test employee standing still then with employee moving head from side to side and up and down. If a half-mask is being tested, instruct the employee to close his/her eyes for the duration of the test.End test if any leakage occurs.

- If the employee detects the odor during fitting, record that respirator as unsatisfactory, remove it from the employee, and visually inspect the facepiece-to-face seal. If any doubt exists about the respirator or cartridges, test a duplicate to assure that the leakage was due to facepiece-to-face seal.

B. Method No. 2 - Around Seal (Particulates)

- Use respirator equipped with high-efficiency filters (HEPA).

- Perform test in an area with no noticeable air movement.

- Use smell oils or something equivalent. Be sure to ascertain from the manufacturer that the product your using for the fit test is appropriate for this use.
- After the employee dons the respirator, tester visually inspects the facepiece-to-face seal. If seal obviously leaks, test ends and mask is recorded as unsatisfactory. If subject is uncomfortable, test ends.

- Direct the smell oils around the sealing surface of the respirator at a distance of 3 to 6 inches. Instruct employee to breathe slowly during the initial test around surface and normally thereafter if no leakage is detected. If a half-mask is being tested, instruct employee to close his/her eyes for the duration of the test. Perform the test with the employee being sedentary, then with the employee moving head and face (i.e. talking, moving head side to side and up and down). End test if any leakage occurs.

- If the employee detects irritation during fitting, record that respirator as unsatisfactory, remove it from the subject, and visually inspect the sealing surface. If any doubt exists about the respirator or cartridges, test a duplicate to assure that the leakage was due to the facepiece-to-face seal.

CARE AND CLEANING OF RESPIRATORS

1. GENERAL REQUIREMENTS

When using a respirator on a routine basis it is necessary that you clean and care for your respirator daily. The purpose of this program is to assure that all respirators are maintained at their original effectiveness. Each employee is responsible for the care and maintenance of his/her respirator.

Each employee at the end of the shift should do the following:

- Inspect for leak
- Clean and disinfect
- Repair if necessary
- Storage in a clean area

2. INSPECTION

Inspect respirators after each use. Inspect monthly a respirator that is kept ready for emergency use to assure it will perform satisfactorily.

Maintain a record for each respirator inspection, including date, inspector and any unusual conditions or findings.

3. CLEANING AND DISINFECTION

Remove all cartridges, canisters, and filters, plus gaskets or seals not affixed to their seats.

Remove elastic headbands.

Remove speaking diaphragm and/or exhalation valve assembly.

Remove inhalation valves.

Wash facepiece and breathing tube in sanitizer mixed with warm water or completely wipe down with disinfecting alcohol. Remove heavy soil from the surface with a hand brush.

Remove all parts from the washwater and rinse at least twice in clean warm water.

Air dry parts in a clean designated area.

Wipe facepiece, valves and seats with a damp lint-free cloth to remove any remaining moisture.

4. REPAIRS

Minor repairs can be made by the employee following manufacturers instruction. No one should

ever attempt to replace components or to make adjustments or repairs beyond the manufacturer's recommendations.

Make repairs as follows:

Disassemble and hand clean the inhalation and exhalation valve assemblies. Exercise care to avoid damage to the rubber diaphragms.

Replace all faulty or questionable parts and assemblies. Use parts only specifically designed for the particular respirator.

Reassemble the entire respirator and visually inspect the completed assembly.

Insert new filters, cartridges, or canisters, as required. Make sure that gaskets or seals are in place and tightly sealed.

5. STORAGE

Follow manufacturers storage instructions, which are always furnished with new respirators or affixed to the lid of the carrying case. In addition, these general instructions may be helpful.

- After respirators have been inspected, cleaned, and repaired, store then so to protect against dust, excessive moisture, damaging chemicals, extreme temperatures and direct sunlight.

- Do not store respirators in cloth lockers bench drawers or tool boxes unless they are sealed in plastic bags. If possible store them in original cartons or carrying cases.

- Draw clean respirators from storage for each use. Each unit can be sealed in a plastic bag, placed in a separate box, and tagged for immediate use.

PERSONNEL PROTECTIVE EQUIPMENT:
CHEMICAL PROTECTIVE CLOTHING

INTRODUCTION

Chemical protective clothing (CPC) is worn to prevent harmful chemicals from coming in contact with the skin or eyes. It provides a barrier between the body and chemicals which have a detrimental effect on the skin or which can be absorbed through the skin affecting other organs. Used with respiratory protection, properly selected chemical protective clothing can protect personnel who must work in a hostile environment from injury.

Protecting workers against skin exposure requires using the most effective chemical protective clothing. Of primary importance is selecting clothing made from a material which is most resistant to the attack chemical. The style of clothing is also important and depends on whether the attack substance is in the air or skin exposure will be from splash or direct contact with solids or semi-solids. Other selection criteria which should considered include the probability of being exposed, ease of decontamination, mobility while wearing clothing, durability of clothing, and to a lesser degree, cost.

A variety of manufactured materials exists which are used to make the fabric for chemical protective clothing. Each of these materials provides a degree os skin protection against a range of chemicals. But no one material affords maximum protection against all chemicals. The chemical protective clothing selected must be made from a material which affords the greatest deterrent against the chemicals known or expected to be encountered.

Properly selected chemical protective clothing can minimize risk of exposure to chemical substances, but may not protect against physical hazards. The use of other personal protective equipment must also be determined for complete ensemble. Head protection is provided by hard hats; eye and face protection by goggles; hearing protection by earmuffs or earplugs; and foot protection by impact resistant and chemically-resistant boots.

CLASSIFICATION OF CHEMICAL PROTECTIVE EQUIPMENT

Chemical protective clothing is classified by style, protective material from which the fabric is made, and whether the clothing is disposable.

Style

Fully Encapsulating Suit (FES): Fully encapsulating, chemical protective clothing is a one piece garment that completely encloses the wearer. Boots, gloves, and facepiece are an integral part of the suit, but may be removed. The respiratory protection is worn inside the encapsulating suit. If removable they are connected to the suit by devices that provide a vapor or gas proof seal. These are gas tight suits and must be periodically pressure tested to ensure integrity.

FES's are primarily for protecting the wearer against toxic vapors, gases, mists, or particulates in air. The protection they provide against a specific chemical depends upon the material from which they are constructed.

Non-Encapsulating Suit (NES): Non-encapsulating chemical protective clothing (splash suits) does not have a facepiece as an integral part of the suit. A positive pressure SCBA, airline, or air-purifying respirator is worn outside the suit. Splash suits are of two types: a one-piece coverall or a two piece setup. Either type may include a hood and other accessories.

Non-Encapsulating suits are not designed to provide maximum protection against vapors, gases, or other airborne substances but against splashes. In effect, splash suits can be made (by taping) to totally enclose the wearer, but they are not considered to be gas tight. They may be substitute for a fully encapsulating suit if the concentration of airborne contamination is low and the material is not extremely toxic to the skin.

Protective Material

Chemical protective clothing also is classified based on the material from which it is made. All materials fall into two general categories, elastomers and non-elastomers.

Elastomers: polymeric (plastic-like) materials, that after being stretched, return to near their original shape. Most protective materials are elastomers. These include: polyvinyl chloride, neoprene, polyethylene, nitrile, polyvinyl alcohol, viton, teflon, butyl rubber, and others.

Non-Elastomers: materials that do not have the quality of stretchability. Non-Elastomers include tyvek, tyvek coated garments, and other materials.

Single-Use

A third classification is single use or disposable garment. This classification is relative and based on cost, ease of decontamination and quality of construction. Disposable chemical protective clothing is commonly considered to be less than $25.00 per garment. In situations where decontamination is a problem more expensive clothing may be considered disposable.

PERFORMANCE REQUIREMENTS FOR CHEMICAL PROTECTIVE CLOTHING

There are a number of performance requirements that must be considered in selecting the appropriate protective material. Their relative importance is determined by the particular work activity and site specific conditions.

Chemical Resistance
Durability
Flexibility
Temperature Resistance

Service Life
Cleanability
Design
Size, color, cost

CHEMICAL RESISTANCE

The effectiveness of materials to protect against chemicals is based on their resistance to penetration, degradation, and permeation. Each of these properties must be evaluated when selecting the style of chemical protective clothing and the material from which it is made. In choosing protective materials:

There is no protective material that is impermeable.

There is no one material that affords protection against all chemicals, and

For certain contaminants and chemical mixtures there are no materials available that will protect for more than an hour after initial contact.

Penetration is the transport of chemicals through openings in a garment. Degradation is a chemical action involving the molecular breakdown of the material due to chemical contact. Permeation is a chemical action involving the movement of chemicals, on a molecular level, through intact material.

Permeation is a process which involves the sorption of the chemical on the outside surface, diffusion through, and desorption of the chemical from the inside surface of the protective material. A concentration gradient is established. Because the tendency is to achieve concentration equilibrium, molecular forces "drive" the chemical into the material toward the area of no or lower concentration. Eventually the highest flow of permeating chemical exists and is referred to as the steady flow state. Permeation rate is the quantity of chemical that will move through an area of protective material in a given time. Another measure of permeation is breakthrough time, expressed in minutes. Breakthrough is the time elapsed between initial contact of a chemical with the outside surface and detection at the inside surface of the material. Several factors influence the rate of permeation and the breakthrough time including the type of material and thickness. Other important factors are chemical concentration, contact time, temperature, material grade, humidity, and solubility of the material in the chemical. The best protective material against a specific chemical is one that has a low permeation rate and a long breakthrough time. However, these properties do not always correlate. A long breakthrough time is usually desired.

The available test data and recommendations for all chemical protective clothing is extremely limited in scope and use. The literature on material testing notes that permeation rates and breakthrough times are not tested for those materials which receive a poor degradation rating; only breakthrough time is measured for those chemicals which are known to be direct skin hazards. The data also reflects the testing of pure substances and not mixtures. The specific chemicals are rated against a variety of protective materials. The ratings are based on two criteria; breakthrough times and vendor chemical resistance data.

PROTECTIVE MATERIALS

There is a wide variety of protective materials. The following is a list of the more common materials used in chemical protective clothing segregated as elastomers or non-elastomers. The sources consulted for the following list included Guidelines for the Selection of Chemical Protective Clothing (ACGIH, Vol. 1, 1985) and manufacturer's literature.

ELASTOMERS		
Material	**Good For**	**Poor For**
Butyl Rubber (Isobutylene/Isoprene Copolymer)	Bases and many organics Heat and ozone resistance Decontamination	Gasoline Aliphatic hydrocarbons Halogenated hydrocarbons Abrasion resistance
Chlorinated Polyethylene (Cloropel, CPE)	Aliphatic hydrocarbons Acids and bases Alcohols Phenols Abrasion and ozone	Amines Esters Ketones Halogenated hydrocarbons Cold temperatures
Natural Rubber (Polyisoprene)	Alcohols Dilute Acids and Bases	Organic chemicals Aging (affected by ozone)
Neoprene (Chloroprene)	Bases and dilute acids Peroxides Fuels and oils Aliphatic hydrocarbons Alcohols Glycols Phenols Abrasion and cut resistance	Halogenated hydrocarbons Aromatic hydrocarbons Ketones Concentrated acids
Nitrile Rubber (Acrylonitrile rubber, Buna-N, NBR, hycar, paracril, krynac)	Phenols PCBs Alcohols Amines Bases Peroxides Fuels and oils Abrasion and cut resistance Flexibility	Aromatic hydrocarbons Halogenated hydrocarbons Amides Ketones Esters Cold temperature

ELASTOMERS		
Material	**Good For**	**Poor For**
Polyurethane	Bases Aliphatic hydrocarbons Alcohols Abrasion resistance Flexibility Cold temperatures	Halogenated hydrocarbons
Polyvinyl Alcohol (PVA)	Almost all organics Ozone resistance	Esters Ethers Acids and bases Water and water solutions Flexibility
Polyvinyl Chloride (PVC)	Acids and bases Some organics Amines Peroxides	Most organic compounds Cut resistance Heat resistance Decontamination
Viton	Aliphatic hydrocarbons Aromatic hydrocarbons Halogenated hydrocarbons Acids Decontamination Physical properties	Aldehydes Ketones Esters (Oxygenated Solvents) Amines
Teflon	Limited Data	Limited Data

Blends and Layers

Chemical protective equipment manufacturer's have developed a technique of layering materials to improve chemical resistance. Essentially one suit is designed with multiple layers. Some examples of layered fully encapsulating suits are viton/butyl (Trelleborg), viton/neoprene (MSA Vautex and Draeger), and butyl/neoprene (MSA Betex).

NON-ELASTOMERS		
Material	**Good For**	**Poor For**
Tyvek (Non-woven polyethylene fibers)	Dry particulate Dust protection Disposable Lightweight	Chemical resistance Durability Penetration Degradation
Polyethylene (Coated tyvek)	Acids and bases Alcohols Phenols Aldehydes Disposable Lightweight	Halogenated hydrocarbons Aliphatic hydrocarbons Aromatic hydrocarbons Penetration Durability
Saranex (Laminated tyvek)	Acids and bases Amines Some organics PCBs Disposable Lightweight Durability	Halogenated hydrocarbons Aromatic hydrocarbons Penetration

SELECTING CHEMICAL PROTECTIVE CLOTHING

Selecting the most effective chemical protective clothing is easier when the chemical for which protection is necessary is known. Selection becomes more difficult when the presence of chemicals is unknown or multiple chemicals are involved, or an unidentifiable substance is present. As uncertainties about the substances involved increases, selecting the proper clothing becomes more difficult.

Another major difficulty in selection is that there is not enough available information concerning the protective qualities of commonly used protective materials against the wide range of chemicals that could be encountered. The selection process consists of:

Deciding that workers must be in an environment where they could be exposed.

Identifying the chemical involved and determining its physical, chemical, and toxicological properties.

Deciding whether, at the concentrations known or expected, the substance is a skin hazard.

Selecting protective material which provides the least permeation and degradation for the longest period of time.

Determining whether a fully encapsulating suit or a non-encapsulating suit is required.

In those incidents where the presence of hazardous substances is not known or they can not be readily identified there are usually clues which can assist in choosing the style of clothing. Observations which could indicate wearing fully encapsulating suits are:

Visible emissions of gases, vapors, dust, and smoke.

Indications of airborne hazards on direct-reading instruments.

Configuration of containers or vehicles which indicate they contain gases or pressurized liquids.

Signs, labels, placards, or bills of lading indicating substances that could become airborne and are toxic to the skin.

Enclosed, poorly ventilated areas where toxic vapors, gases, and other airborne substances could accumulate.

Work functions required might expose workers to high concentrations of skin toxins.

Unknown situations require considerable judgement as to whether maximum protection to the skin is necessary, or whether splash suits are appropriate. After determining the type of protective garment to be worn, the next step is to select the protective material. The best protective material against a specific chemical would be one that has a very low permeation rate, a long breakthrough time, and has been constructed free of design imperfections. Permeation is the primary selection criteria. Degradation information is less useful. Degradation data can help in assessing the protective capability of materials, if no other data is available.

However, a fabric with a good degradation resistance may be very permeable to the same chemical. Permeation and degradation are not directly related and cannot be used interchangeably. In those situations where a protective material can not be chosen because of uncertainty of the attack substance, there are some reasonable options.

Select a protective material which protects against the greatest range of chemicals. These are generally garments made from butyl rubber, viton, or teflon. Chemicals against which these materials do not provide protection could possibly be eliminated as not being present.

Clothing made of multiple layered protective material could be used.

Whether fully encapsulating or non-encapsulating clothing should be worn may not be self-evident. If based on an assessment of the situation it is determined that either style would provide effective protection other factors to consider would be:

Ease in wearing/comfort

Communication ability

Decontamination ability

Heat stress

Cost

PHYSICAL STRESS

Wearing chemical protective clothing can cause problems. These involve heat stress, accident proneness, and fatigue. The major problem is heat stress caused by protective clothing interfering with the body's ability to cool itself. Clothing that provides a barrier against chemicals contacting the skin,prevents the efficient dissipation of body heat. Additional strain is put on the body as it attempts to maintain it's heat balance. This added stress can result in health effects ranging from transient heat fatigue to serious illness or death.

The smaller the area of the body exposed to the air, the greater the probability for heat stress. Fully encapsulating suits allow no ambient air to contact the skin's surfaces to aid in the evaporation of moisture. Heat in these suits builds up quickly. Splash suits may allow more body surface to be cooled by the air. Although wearing protective clothing establishes conditions that are conducive to heat-related illness, individuals vary in their susceptibilitv to heat stress and their ability to withstand high temperatures.

Accident proneness also increases when wearing chemical protective clothing. Suits are heavy, cumbersome, decrease mobility and dexterity, lessen visual and audio acuity, and increase physical exertion. The severity of the problems depend on the style of clothing worn. These negative qualities increase the risk of common accidental injury.

Increased physical exertion caused by working in protective clothing can in itself cause problems. Worker performance may decrease due to increased fatigue levels. Other more serious illnesses such as stroke or heart attack could occur.

To minimize the adverse effects of physical stress, workers wearing protective clothing must change their normal work regimen. A medical surveillance program should be instituted. Personnel must be allowed to acclimate to stressful environmental factors by varying work and rest periods as needed. Projects should be scheduled for cooler periods of the day when possible. The intake of fluids must be maintained at levels to prevent dehydration. Compensatory efforts such as these must be established as part of Standard Operating Procedures on a site-specific basis to reduce the risks associated with wearing protective clothing.

INSPECTION OF PROTECTIVE CLOTHING

Before wearing chemical protective clothing it must be properly inspected. The following is a checklist for visually inspecting all types of chemical protective suits. Chemical suits should be inspected immediately before use and monthly when not in use.

Spread suit out on a flat surface.

Examine the outside for the following:

- fabric for abrasions, cuts, holes, or tears
- fabric has retained the original flexibility and durability
- seams for separations or holes
- zippers, buttons, storm flaps, and other connecting devices for proper sealing
- signs of previous chemical attack or incomplete decontamination
- elastic around wrists and ankles and the draw strings on hoods are in good condition

Fully encapsulating suits require additional inspection which include:

- Exhalation valves for debris and proper functioning
- Suit facepiece for poor visibility
- Suit seal with facepiece

Presence and condition of waist belts, velcro adjustments, and ankle straps

Condition of integral gloves, boots, and leg gaiters

Presence of hard hat or ratchet head suspension

Presence and condition of airline attachment and hoses

Leak detection and pinholes

If an air source is available, secure the suit and inflate it, then using a mild soap solution observe for bubbles on the surface or around seams, or inside a dark room, run a flashlight inside the suit and look for pinpoints of light from outside the suit. See OSHA 1910.120 Appendix A for more test methods.

Records should be maintained on each suit's inspection, use conditions, and repair status. These records are especially important for fully encapsulating suits which are usually not individually assigned but shared.

CONCLUSION

There are many different types of chemical protective clothing. When selecting chemical protective clothing it is important to remember the use for which the clothing is intended,
amount of time the clothing will be worn, ability to decontaminate clothing, durability, weight, and worker acceptance.

APPENDIX D

EMPLOYEE PERFORMANCE EVALUATIONS AND ACCIDENT REPORT FORMS

APPENDIX E

GLOSSARY OF TERMS AND LIST OF ACRONYMS

APPENDIX E

GLOSSARY OF TERMS
AND LIST OF ACRONYMS

A

Absolute Density or Gravity:	The density or specific gravity of a liquid material at standard conditions. 0 degrees Centigrade.
Acidosis:	A physical state characterized by a decrease of alkali in bodily fluids in proportion to the content of acid. Central nervous system tissue and other tissue may be adversely effected by acidosis.
Acid:	A hydrogen containing compound which reacts with water to produce hydrogen ions. A liquid with a pH of 2 or less. An acidic chemical is corrosive.
Acute:	A short term period of action measured in seconds, minutes, hours or days.
Acute Dermal Toxicity Test:	A test used to determine the possible toxic effects of a chemical upon skin contact. A single dose of the material is placed on the skin of a test animal.
Acute Effect:	An adverse effect on human or animal bodies, with severe symptoms that develop rapidly and come quickly to a crisis.
Acute Inhalation Toxicity Test:	A test used to determine the possible adverse effects of inhalation of gases, vapors, mists,dusts or fumes.
Acute Oral Toxicity Test:	A test used to determine the possible systemic toxicity of a material after ingestion.

Acute Toxicity:	The adverse effects of a short term exposure or one-time exposure to a substance.
Aerosol:	Solid or Liquid particles suspended in a gaseous medium.
Alkali:	A substance that has the ability to neutralize an acid. An alkaline substance will turn litmus paper blue. An alkali is irritating to the skin, eyes, and mucous membranes. Common alkali are sodium hydroxide and potassium hydroxide.
Allergic Reaction:	A physiologic reaction to a chemical or other physical stimulus by a sensitive person. Some skin rashes or asthma-like reactions result from allergic reactions.
ACGIH:	American Conference of Governmental Industrial Hygienists. An organization of professionals that develops and publishes recommended occupations exposure limits for chemical substances and physical agents.
Anesthetic Effect:	A temporary loss of sensation induced by a chemical agent, which reduces the ability to feel pain or other sensations. Hydrogen sulfide has an anesthetic effect on the olfactory nerve and reduces the ability to smell the gas.
Appearance:	The describable characteristics of a material, including the color, physical state at different conditions, the consistency, etc.
Aromatics:	Pertains to the six-carbon ring configuration of organic compounds such as benzene. The name is derived from their rather pleasant odor. Includes toluene and xylene.
Asphyxiant:	A vapor or gas that can cause death by suffocation.
Aspiration Hazard:	The possibility of drawing a fluid into the lungs and causing an inflammatory response to occur.

ASTM: American Society for Testing and Materials. An organization concerned with consensus standards for materials, products, systems, and services. Membership is voluntary.

Autoignition Temperature: The lowest temperature at which a flammable gas or vapor-air mixture will spontaneously ignite without spark or flame.

B

Barrier Cream: An inaccurate term for protective cream. See Protective Cream.

Blasting Agents: DOT Hazard Classification applied to those substances that have little probability of accidental initiation.

Boiling Point: The temperature at which a liquid changes to vapor, under a give pressure. (Usually expressed in degrees Fahrenheit at sea level pressure.) A flammable material with a low boiling point can present special fire hazards. In describing mixtures, the initial boiling point or a boiling range may be given.

Bronchitis: An irritation or inflammation of one or more of the bronchial tubes. Can be caused by inhaling some vapors of gases. Characterized by fever, pain in the chest, shortness of breath and coughing.

C

"C" or Ceiling: The absolute maximum human exposure limit for an airborne substance. This limit of exposure is not to be exceeded even momentarily.

C: Abbreviation for centigrade.

CAA: Clean Air Act. A federal law that regulates and reduces air pollution. This act is administered by the E.P.A.

Carbon Monoxide:	A colorless, flammable essentially odorless gas that is produced by the incomplete combustion of carbon compounds. A toxic gas that acts as a chemical asphyxiant.
Carcinogen:	A cancer causing substance or agent.
C.A.S.	Chemical Abstracts Service. An organization that indexes the information published in "Chemical Abstracts", and provides guides by which information about particular substances may be located in the "Abstracts". "C.A.S. Numbers" identify specific chemicals.
C.A.S. Number	A number assigned to a substance by the Chemical Abstracts Service.
cc:	Cubic Centimeter. A volume measurement in the metric system. 1 cc is equal to 1 milliliter. One quart is 946.358 cubic centimeters.
Celsius:	Same as centigrade.
Centigrade:	The temperature scale in which there are 100 degrees between the freezing point (0 degrees C) and the boiling point (100 degrees C) of water.
CFR:	The standards, regulations and rules known as the Code of Federal Regulations.
Chemical Asphyxiant:	Any substance that prevents the body from receiving or using oxygen. Carbon Monoxide is a chemical asphyxiant.
Chemical Family:	Groups of compounds with related properties. For example: Acetone, methyl ethyl ketone, and methyl isobutyl ketone are of the ketone family.
Chemical Pneumonitis:	An inflammation of the lungs caused by chemical irritation.
CHEMTREC:	Chemical Transportation Emergency Center. A national center established by the Chemical Manufacturers Association to relay emergency information conc ning specific chemicals that have been involved in a transportation

emergency.

Chronic Effect:	Adverse effect on a human or animal body. The symptoms develop slowly or recur frequently.
Chronic Toxicity:	Chronic adverse effect caused by repeated exposure to a substance over a period of time.
Chronic Toxicity Data:	Information obtained as a result of testing for chronic toxicities.
CNS:	Central Nervous System. Composed of the spinal cord and brain.
CNS Depression:	Loss of sensation or a lowered sensitivity level in the CNS, caused by exposure to chemicals or anesthetics.
Cocarcinogen:	A material that increases the effect of a carcinogen.
CO2:	Carbon Dioxide. A colorless, nonflammable gas. A byproduct of combustion and other processes, including breathing. Is a simple asphyxiant in high concentrations. Used in fire fighting.
COC:	Cleveland Open Cup. A flash-point test method.
Coma:	Deep unconsciousness.
Combustion Products:	Substances produced from burning of a material.
Combustion:	Burning. A chemical process accompanied by light and heat.
Combustible:	Capable of fueling a fire. A classification of liquids based on their flash points.
Combustible Liquid:	A liquid having a flash point equal to or greater than 100 degrees F and below 200 degrees F.

Concentration:	The amount of a substance in a stated unit of mixture or solution.
Conditions Contributing to Instability:	Conditions encountered during the use or storage of a material that may cause it to become unstable.
Contaminated:	The presence of a material that renders a material impure.
Corneal/conjunctival Burns:	A burn to the membrane covering the eye or the lining of the eyelids.
Corrosive:	A material that causes destruction or irreversible damage to human skin or has a severe corrosion rate on steel.
Cutaneous:	Relating to the skin or skin structures.

D

Decomposition:	The breakdown of a material into simpler substances.
Deflagration:	Rapid Burning with intense heat.
Dehydrating Agent:	A material that can deplete body fluids or remove moisture from another material.
Dehydration:	The removal of water from a substance. An abnormal depletion of body fluids.
Dermal:	Pertaining to the skin.
Dermal Toxicity:	Adverse effects from exposure to a substance.
Dermal Sensitization:	An immune response triggered by exposure to a substance. A much stronger response will often occur with subsequent exposure.

Dermal Sensitization Study:	A test used to determine a material's potential to produce an allergic reaction on the skin.
Dermatitis:	Inflammation of the skin.
Detonation:	Explode with sudden force.
Distillation:	A process used for purification. The process drives vapors from a hydrocarbon solution by heating.
D.O.L.:	The U.S. Department of Transportation. Regulates transportation of chemicals, hazardous and non-hazardous substances.
D.O.T.:	Department of Transportation. Regulates transportation of chemicals, hazardous and non-hazardous substances.
DOT Hazard Class:	The type of hazard that may be encountered in an emergency during transport. Defined by the DOT. Includes classifications such as flammable, corrosive, poison, etc.
Downwind:	The direction toward which the win is blowing.
Dry Chemical:	A powdered fire-extinguishing agent used on Class B and C fires. Usually composed of sodium bicarbonate, potassium bicarbonate, or urea-based potassium bicarbonate.
Dusts:	Solid particles generated by some mechanical processes. (e.g., blasting, crushing, grinding.)

E

Effects of Overexposure:	Clinical signs of symptoms that may occur after overexposure to a particular substance.

Emergency First Aid Procedures:	Recommended treatment procedures to be followed immediately after exposure to a toxic material or accident.
Environmental Impact:	Refers to the possible adverse effects if the material is accidently released into the environment.
EPA:	U.S. Environmental Protection Agency. A federal agency with regulatory and enforcement responsibilities for laws regarding the protection of air, land and water from pollutants.
Epidemiology:	The health field concerned with the causes of outbreaks of infection and disease.
Ergonomics:	The study of the interaction between human beings and environmental design factors.
Erythema:	Redness of the skin. May result from exposure to a substance or product.
Evaporation Rate:	The rate at which a particular material will vaporize when compared to the rate of vaporization of a known material.
Excepted from DOT Regulations:	A hazard class applied to a substance that are not included in and of the other Department of Transportation hazard classes.
Explosive:	Any chemical compound or device with the primary purpose of exploding. Any material having the primary properties of explosives. 1) Class A Explosive - D.O.T. classification for those substances that pose a maximum explosion hazard. 2) Class B Explosive - D.O.T. classification for substances that function by rapid combustion rather than detonation. 3) Class C Explosive - D.O.T. classification for substances that contain C. .ss A or B explosives.

Explosion Hazard:	Hazard that could result from exposure of a material to heat or flame.
Explosive Limits:	The range of concentration of a flammable gas or vapor in which explosion can occur if an ignition source is present.
Extinguishing Agents: (Methods)	Any agent suitable for controlling or putting out a fire.
Eye Irritation Study:	A single dose of a material is placed in the eyes of a test animal to evaluate the potential of the material to produce eye damage.
Eye Protection:	Any properly used safety glasses, goggles, etc. designed for wear when handling a potentially irritating material.

F

F:	Fahrenheit. A temperature scale in which the boiling point of water is 212 degrees above zero and the freezing point of water is 32 degrees above zero.
Fatal:	Deadly, lethal.
Fertile:	Capable of developing into a new individual or to produce young.
Fetal:	Pertaining to the unborn your of an animal.
Fibrosis:	An abnormal increase in the amount of fibrous connective tissue in an organ.
Fire-Fighting Procedures:	Procedures designed to be used in a fire-fighting situation to minimize injury and damage.
Fire Hazard:	A danger that may result from exposure of a material to heat or flame.

Fire Point:	The lowest temperature at which a material can evolve vapors fast enough to support continuous combustion.
First-Degree Burn:	A burn of the first layer of skin characterized by redness and mild pain.
Flammable:	A substance that can be ignited and burns with extreme rapidity.
Flammable Gas:	A hazard classification that is applied to a gas meeting the lower flammability limit.
Flammable Limits:	The range of a gas concentration in air that will burn or explode if an ignition source is present.
Flammable Liquid:	Any liquid with a flash point below 100 degrees F and a vapor pressure not exceeding 40 psi at 100 degrees F.
Flammable Solid:	A hazard classification applied to any solid material other than explosive that is liable to cause fire through friction or retained heat from manufacturing or processing. Any solid that can be readily ignited and burn rapidly.
Flash Point:	A minimum temperature at which a liquid gives off sufficient vapor to form an ignitable mixture with air.
TCC	Tagliabue Closed Tester (see American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 1971 (ATSM D 56-77) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100°F (37.8°C), that do not contain suspended solids and do not have tendency to form a surface film under test; or
PMCC	Pensky-Martens Closed Tester (see American National Standard Method for Flash Point by Pensky-Martens Closed Tester, Z11.7-1974 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C), or that contain suspended solids, or that have tendency to form a surface film under test; or

SETA	Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)). NOTE: For mixtures, if the result of any test method is above 100°F (37.8°C), a fresh sample shall be evaporated to 90% of the original volume and retested. The lower of the two values shall be taken as the flash point.
Foam:	Term generally used to mean a fire-fighting agent.
Frostbite:	Tissue damage resulting from exposure of the skin to extreme cold.
Fumes:	Terms generally applied to the metal oxides of zinc, magnesium, lead and others. Formed by manufacturing processes such as combustion or condensation.

G

G:	Gram. A unit of weight in the metric system. An ounce is equal to 28.34 grams.
Gas:	A formless fluid that occupies the space of an enclosure and can be changed to a liquid or solid by the effect of increased pressure and decreased temperature.
Gastric Lavage:	The washing out of the stomach with an innocuous substance by means of a gastric tube.
Gastrointestinal Disturbances:	An upset stomach or intestine.
General Exhaust:	The removal of contaminated air from a large area by use of an air circulation of exchange system.
Genetic Toxicity Data:	Can indicate evidence of changes in a cell's genetic material, using whole

animals or cells grown in tissue cultures.

g/KG: Grams per Kilogram.

gm: Gram.

H

Hazardous Material: A substance that can produce adverse effects on the health or safety of a human being or the environment.

Hazardous Reaction/ Decomposition: Hazards of the by-products from a chemical change in the substance. Includes the generation of heat or explosion.

Hydrocarbons: Organic compounds composed of carbon and hydrogen. The most common chemical industry sources are petroleum, natural gas, and coal.

Hygiene: A science concerned with health and its preservation. The main concern of industrial hygiene is the measurement and control of work and environmental health hazards.

I

Ignitable: Any substance that has a "characteristic of ignitability" as defined by the Resource Conservation and Recovery Act. May be regulated by the E.P.A. as a hazardous waste.

Ignition Source: Anything that provides enough heat, spark, or flame to cause combustion or explosion.

Impurity: A chemical substance which is unconditionally present with another chemical substance or mixture.

Incendiary Spark: A small, hot particle of a substance that is thrown out by a material during combustion, or remaining when combustion is nearly complete. This particle can ignite other materials in the area.

Incompatible: Materials that can cause dangerous reactions when coming into direct contact with each other.

Ingestion: Swallowing of a substance.

Inhalation: The breathing in of a substance.

Intestinal Upset: A stomach ache. Disturbed digestive processes.

Irritant: Any substance that can cause an inflammatory response of the eye, skin, or respiratory system following exposure.

Irritating Material: A substance which, upon contact with fire or when exposed to air, gives off irritating or dangerous fumes. Does not include poisons, as defined by the D.O.T.

K

Kg: Kilogram. A metric unit of weight that equals 2.204 U.S. pounds.

L

Landfill: A method of disposal or the site itself. Solid or liquid waste is buried in layers of earth.

L: A liter. A metric unit of volume. 1 liter = 1.056 U.S. quarts.

LC 50: Lethal concentration 50. The concentration of a material which is expected to kill 50% of a group of test animals when administered orally or applied to the skin.

LEL or LFL: Lower Explosive Limit or Lower Flammable Limit. Lowest concentration of a gas or vapor in air below which propagation of a flame will not occur in the presence of an ignition source.

Local Exhaust: A system for removing airborne contaminants from the air at the point at which they are released.

M

M_3: A cubic meter. A metric unit of volume. 1 cubic meter = 35.314 cubic feet.

Melting Point: The temperature at which a solid turns into a liquid.

Mechanical Exhaust: A powered device for exhausting contaminants from a workplace, vessel or enclosure.

mg: Milligram. A metric unit of weight. 1,000 milligram = 1 gram.

mg/Kg: Milligrams per kilogram.

mg/m^3: Milligrams per cubic meter. Used for measuring concentrations of particles or gases in the air.

Mist: Suspended liquid droplets in the air.

Mixture: Combination of two or more substances that can be separated by mechanical means.

ml: Milliter. A metric unit of volume. 1,000 milliliters = 1 liter.

mm/Hg: Millimeters of mercury. A unit of measurement for pressure.

MSHA: The Mining Safety and Health Administration of the U.S. Department of Labor. Has safety and health regulatory and enforcement responsibility for the mining industry.

Mucous Membrane: Any mucous secreting membrane lining the organs of the body.

Mutagen: An agent capable of altering the genetic material of a living cell.

N

n.a.: Not applicable.

Nasal Cavity: Either of the pair of cavities of the nose separated by the septum.

Nausea: An unpleasant sensation in the stomach often leading to vomiting.

n.d.: An abbreviation for "no data available".

Neutralize: To render chemically neutral or harmless.

NIOSH: National Institute for Occupational Safety and Health of the Public Health Service. The federal agency which tests and certifies respiratory protective devices and air sampling detector tubes. Also recommends occupational exposure limits for various substances and assists OSHA and MSHA in occupational safety and health investigations and research.

Nitrogen: (N2) A colorless, odorless, tasteless gas that will not burn or support combustion. At high concentrations, can displace oxygen and become a simple asphyxiant.

Noncombustible:	Any material that will not ignite, burn, support combustion or release flammable vapors.
Nonflammable Gas:	Any compressed gas other than flammable. D.O.T. hazard class.
n.o.s.:	Abbreviation for "not otherwise specified". A shipping classification for substances to which a restriction applies, but not listed in D.O.T. regulations.
NOx:	Nitrogen oxides. These gases are undesirable air pollutants, and are regulated by the E.P.A.
N.R.C.:	Nuclear Regulatory Commission. Regulates the commercial aspects of nuclear energy, including licensing, inspection and enforcement.

O

Ocular:	Pertaining to the eyes.
Odor:	A smell. Odor threshold refers to the concentration required in the air before vapors are detected or recognized.
Oil-Impervious Garments:	Any clothing that does not allow the passage of oil to the skin.
Oil Mist:	A fine spray of oil particles suspended in the air.
Olfactory:	Pertaining to the sense of smell.
Oral:	Pertaining to or affecting the mouth.
Oral LD 50:	Oral lethal dose. The concentration of a substance administered by mouth that will kill 50% of the animals tested.
Oral Toxicity:	The adverse effects that will result from taking a substance by mouth.

Organic Liquids:	Any liquid chemical compounds containing carbon.
Organic Peroxide:	A hazard classification by the D.O.T. that is applied to an organic compound containing the bivalent -00- structure. May be considered a derivative of hydrogen peroxide in which one or more of the hydrogen atoms have been replaced by organic radicals.
ORM-A:	A D.O.T. hazard classification applied to a material that has an anesthetic, irritating, noxious, toxic, or other similar property.
ORM-B:	A D.O.T. hazard classification that is applied to a material capable of causing significant damage to a vehicle or transporting vessel by leaking during transportation.
ORM-C:	A D.O.T. classification applied to a material that has characteristics not described as a ORM-A or ORM-B, but that is unsuitable for transport unless properly identified and prepared.
ORM-D:	A D.O.T. hazard class applied to a material that presents a limited hazard during transportation due to its form, quantity and packaging.
ORM-E:	A hazard class applied to a material that is not included in any other D.O.T. hazard class, but that is subject to the requirements of the D.O.T., such as "Hazardous Waste Solid".
O.S.H.A.:	Occupational Safety and Health Administration. A part of the U.S. Department of Labor. Has safety and health regulatory and enforcement responsibilities.
Oxidation:	A chemical reaction brought about by an oxidizing agent in which an atom or molecule loses electrons.
Oxidizer:	A substance that yields oxygen readily to stimulate the oxidation of organic matter. (example: Chlorate and Permanganate.)

Oxidizing Agent:	A chemical or substance that brings about an oxidation reaction. (example: chlorine.)

P

Paralysis:	Loss of function of a sense or partial or complete loss of motor function of a part of the body.
Particulate:	Pertaining to small pieces of matter. dusts, fumes, smokes, mists and fogs are all examples of particulates.
Pathological Change:	Abnormal structural or functional change in body caused by a disease or exposure to a toxic substance.
PEL:	Permissible Exposure Limit. Exposure limit established by OSHA's regulatory authority. May be a time weighted average limit or a maximum concentration exposure limit.
Percent Volatile:	The percentage of a liquid or solid that will evaporate at 70 degrees Fahrenheit. (example: butane, gasoline and paint thinner are 100% volatile. Over a period of time each will evaporate completely.
Photosensitization:	Swelling or a dermatitis caused by light exposure after exposure to some chemicals.
Physiologic:	Pertaining to the normal functioning of the body, tissue or an organ.
Plumbism:	Lead Poisoning.
PMCC:	Pensky-Martens Closed Cup. A flash-point test method.
Pneumonitis:	Inflammation of the lungs. Can be caused by inhalation of some chemicals.

Poison, Class A:	A D.O.T. classification for extremely dangerous poisons. (example: phosgene, cyanogen, hydrocyanic acid.)
Poison, Class B:	A D.O.T. class for a substance other than Class A poisons that are known to be so toxic as to afford a hazard to health during transportation.
Polymer:	A material formed by joining together five or more molecules. Cellulose and vulcanized rubber are naturally occurring polymers. Most resins, like polyethylene, are chemically produced polymers.
Polymerization:	A chemical reaction in which a large number of relatively simple molecules combine to form a large, chain-like molecule. Reaction can be hazardous if it takes place at a rate that releases large amounts of energy.
Polymerization Inhibitor:	A substance that slows the polymerization reaction.
Polynuclear Aromatic Polymers:	Organic compounds usually composed of three or more aromatic rings. Some are believed capable of causing skin tumor formation.
ppm:	Parts per million.
ppb:	Parts per billion.
Precautionary Statements:	A warning to product users of potentially harmful hazards that may be attributed to the product.
Product/Material:	The name of the product, usually located at the top of the MSDS>
Protective Cream:	A skin cream that provides a protective barrier from some irritants.
Protective Garments:	Clothing designed to provide protection to the wearer against contamination from chemicals, biological, radiation or physical hazards.
psi:	Pounds per square inch. A unit for measuring pressure.

Pulmonary Edema:	Abnormal accumulation of fluid in the tissues of the lungs.
Pyrolysis:	The breaking apart of complex molecules into simpler units using heat.

R

Radioactive:	The property of an isotope of an element that is characterized by the giving off of radiant energy in particles or rays by the disintegration of atomic nuclei.
Radioactive Material:	A D.O.T. hazard class applied to any material that will spontaneously emit ionizing radiation having a specific activity greater than 0.002 microcurie/g.
Radioactivity:	Emission of energy in the form of alpha, beta, or gamma radiation from the nucleus of an atom.
Reaction:	A chemical transformation or change.
Reactivity:	The tendency of a substance to undergo a chemical change with the release of energy.
Reducing Agent:	In a reduction reaction, the reducing agent is the chemical or substance which (A) combines with oxygen,or (B) loses electrons to the reaction.
RTECS:	Registry of Toxic Effects of Chemical Substances. A gathering of data extracted from scientific literature.
Reproductive Toxicity Data:	Information obtained through the performance of reproduction tests. This type of testing attempts to assess the changes in the reproductive functions of animals, and effects to their offspring.
Respiratory Protection:	Devices for use in protecting the respiratory system from exposure to airbc ıe contaminants.

Respiratory System: The breathing system.

S

Second-Degree Burn: A burn that is more severe than a first degree burn. Blisters, reddening of the skin and edema often characterize this type of burn.

Sensitizer: A substance that may not cause any allergic reaction on the first exposure, but that will cause reactions on the second and subsequent exposure.

SETA: Setaflash closed Tester. A flashpoint test method.

Simple Asphyxiant: Any substance that causes a deficiency in the supply of oxygen to the body by excluding oxygen from the lungs. (Nitrogen, propane, acetylene and others.)

"Skin": A notation that indicates that the substance can be absorbed through the skin and that this exposure route must be considered a part of the total exposure to avoid exceeding the total exposure limits.

Skin Irritation Test: A test used to study the degree of irritation to the skin by a substance.

Skin Lesion: An abnormal change in the skin. Can be caused by injury or disease.

Skin Protection: The recommended type of clothing and equipment to be worn to protect the skin from exposure to the substance.

Smoke: Small particles generated by the incomplete combustion of an organic substance.

Solubility in Water: The percentage of a material that will dissolve in water at a specified temperature.

Solution: A uniformly dispersed mixture.

SOx:	Oxides of sulfur. An air pollutant regulated by the E.P.A.
Species:	A biological type.
Spill and Leak Procedures:	Methods used in clean up of a substance.
Specific Gravity:	The ratio of the weight of a volume of material to the weight of an equal volume of water.
Stability:	The ability of a material to remain unchanged.
Static Discharge:	Discharge of accumulated static electricity.
Static Electricity:	The electrical charge caused by friction or induction between two objects. Similar electrical charges can be generated by rapid flow of gases or liquids.
STEL:	Short-term exposure limit. Terminology used by the American Conference of Governmental Industrial Hygienists. See TLV-STEL.
Subchronic Toxicity Data:	Information gained from subchronic toxicological tests. A dosage of a substance is administered to animals on a daily basis for a long period of time.
Synonyms:	Words having the same or nearly the same meaning. In the chemical industry, a chemical or product having more than one name.
Syrup of Ipecac:	A solution made from the ipecacuanha plant used to induce vomiting in some cases of poisoning.
Systemic Toxicity:	The adverse effects of a substance that occur in the body in general as opposed to a local reaction.

TCC: Tagliabue Closed Cup; A flash point test method.

Terata: Malformation in the fetus.

Teratogen: A substance that can cause malformations in the fetus if the parent is exposed.

Thermal Decomposition: The breaking apart of complex molecules into simpler units using heat.

Thermolabile Substance: A substance that is subject to alteration or destruction by heat.

Thermal Processing: A process using heat to accomplish chemical change.

Third-Degree Burn: A burn severe enough to cause tissue death and charring of the skin. The most serious type of burn, can be fatal.

TLV: Threshold Limit Value. The airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects. Defined by the ACGIH.

TLV-C: Ceiling Exposure Limit. The concentration of a substance that should not be exceeded even for a moment.

TLV-STEL: The short-term exposure limit, or the maximum concentration for a continuous 15 minute exposure period. A maximum of four exposure periods per day.

TOC: Tagliabue Open Cup. A flash-point test method.

Toxicity: The property of being poisonous, of being deadly or causing severe temporary or permanent disability.

Toxicological Data:	A section of the MSDS that contains information on the harmful effects of exposure to a substance.
Trade Name:	The commercial name or a trademark name for a product.
Transient:	Short in duration.
Tumor:	An abnormal, uncontrolled growth of cells.
TWA:	Time Weighted Average exposure. The airborne concentration of a material to which a person is exposed.
Typical:	Exhibits the same or similar characteristics of a group.

U

Ulcer:	A lesion on the surface of the skin or mucous membrane.
Unconscious:	Incapable of responding to sensory stimuli.
Unstable:	Tending toward decomposition or other unwanted chemical change during normal handling or storage.
UN/NA Number:	Numerical designation for transportation hazards. UN = United Nations, NA = North America.
Upper Exposure Limit (UEL) of Upper Flammable Limit (UFL):	The highest concentration of a gas in the air that will produce a flash or fire. Higher concentrations are too rich to burn.
Upwind:	In the direction from which the wind is blowing.

V

Vapor:	The gaseous form of a substance that is normally a liquid.
Vapor Density:	The weight of a vapor or gas compared to the weight of an equal volume of air.
Vapor Pressure:	The pressure exerted by a vapor above its own liquid in a closed container.
Ventilation:	A method of moving air to reduce hazardous substances in the air.
Viscous:	Having resistance to flow.
Viscosity:	The internal resistance to flow exhibited by a liquid.

W

Waste Disposal Methods:	The methods used for disposal of a product as recommended by local, state and federal authorities.
Waterless Skin Cleanser:	A paste or liquid used for the removal of dirt and contamination from the skin without the use of solvents.

ACRONYMS

AA	-	Assistant Administrator
ACE	-	US Army Corps of Engineers (COE)
ADCR	-	Automated Document Control Register
A&E	-	Architecture & Engineering
AER	-	Appropriate Extent of Remedy
AM	-	Action Memorandum
AO	-	Administrative Officer
AO	-	Administrative Order
AOC	-	Administrative Order on Consent
CA	-	Cooperative Agreement
CAA	-	Clean Air Act
CD	-	Consent Decree
CDC	-	Centers for Disease Control
CEAT	-	Contractor Evidence Audit Team
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	-	Code of Federal Regulations
CH	-	Clearing House
CHEMTREC	-	Chemical Transportation Emergency Center System
CHRIS	-	Chemical Hazard Response Information System
CIS	-	Chemical Information System
CLP	-	Contract Laboratory Program
CMS	-	Case Management System
CO	-	Contracting Officer
COE	-	US Army Corps of Engineers
CPAF	-	Cost-Plus-Award-Fee
CPFF	-	Cost-Plus-Fixed-Fee
CRA	-	Community Relations Assessment
CRP	-	Community Relations Plan
CWA	-	Clean Water Act
DBA	-	Data Base Analyst
DCN	-	Document Control Number

DCR	-	Document Control Register
DMB	-	Data Management Branch
DO	-	Duty Officer
DOA	-	Department of Agriculture
DOC	-	Department of Commerce
DOD	-	Department of Defense
DOE	-	Department of Energy
DOI	-	Department of Interior
DOJ	-	Department of Justice
DOL	-	Department of Labor
DOS	-	Department of State
DOT	-	Department of Transportation
DPO	-	Deputy Project Officer
EA	-	Endangerment Assessment
EADS	-	Environmental Assessment Data System
EDD	-	Enforcement Decision Document
EERU	-	Environmental Emergency Response Unit
EMIS	-	Enforcement Management Information System
EMSL-LV	-	Environmental Monitoring Systems Laboratory-Los Vegas
EPA	-	Environmental Protection Agency
EPIC	-	Environmental Photographic Interpretation Center
ERB	-	Environmental Response Branch
ERCS	-	Emergency Response Cleanup Services
ERD	-	Emergency Response Division
EROD	-	Enforcement Record of Decision
ERRIS	-	Emergency & Remedial Response Information System
ERT	-	Environmental Response Team
ESD	-	Environmental Services Division
FCC	-	Fiscal (Financial) Control Center, OERR
FDO	-	Fee Determination Official
FEMA	-	Federal Emergency Management Agency
FIT	-	Field Investigation Team
FMD	-	Financial Management Division (EPA)
FMO	-	Financial Management Officer
FMS	-	Financial Management System

FNSI	-	Finding of No Significant Impact
FR	-	Federal Register
FRP	-	Funding Recommendations Package
FS	-	Feasibility Study
FSR	-	Financial Status Report
FTE	-	Fulltime Equivalent
FWPCA	-	Federal Water Pollution Control Act
FY	-	Fiscal Year
GAD	-	Grants Administration Division
GOB	-	Grants Operations Branch
HACS	-	Hazard Assessment Computer System
HHS	-	Department of Health and Human Services
HIDS	-	Hazardous Incident Data System
HQ	-	EPA Headquarters
HQRS	-	Headquarters Reporting System
HRS	-	Hazard Ranking System
HSCD	-	Hazardous Site Control Division
HSED	-	Hazardous Site Evaluation Division
HWDMS	-	Hazardous Waste Data Management System
IAG	-	Interagency Agreement
IFB	-	Invitation for Bids
IG	-	EPA Inspector General
IPL	-	Interim Priority List
IR	-	Immediate Removal
IRM	-	Initial Remedial Measure
JLC	-	Justification for Limited Competition
JNCP	-	Justification for Non-Competitive Procurement
LOC	-	Letter of Credit
LOE	-	Level of Effort
MBE	-	Minority Business Enterprise
MIDSD	-	Management Information & Data Systems Division
MOU	-	Memorandum of Understanding
NCC	-	National Computer Center
NCLP	-	National Contract Laboratory Program
NCP	-	National Oil and Hazardous Substances Contingency Plan (40 CFR 300)

NDD	-	Negotiation Decision Document
NEIC	-	National Enforcement Investigation Center
NEPA	-	National Environmental Policy Act
NIOSH	-	National Institute of Occupational Safety and Health
NOAA	-	National Oceanic Atmospheric Administration
NOTIS	-	103(c) Notifications
NPL	-	National Priorities List
NRC	-	National Response Center
NRT	-	National Response Team
NSF	-	National Strike Force
OECM	-	Office of Enforcement and Compliance Monitoring (EPA)
OERR	-	Office of Emergency and Remedial Response
OGC	-	Office of General Counsel (EPA)
OHMCS	-	Oil and Hazardous Material Coordinators
OHMTADS	-	Oil and Hazardous Material Technical Assistance Data System
OIC	-	Office of the Inspector General
OIRM	-	Office of Information Resources Management
OLEC	-	Office of Legal and Enforcement Counsel
O&M	-	Operations and Maintenance
OMB	-	Office of Management and Budget
OMSE	-	Office of Management and Systems Division
OPA	-	Office of Public Affairs
OPPM	-	Office of Policy and Program Management
ORC	-	Office of Regional Counsel (EPA)
ORD	-	Office of Research and Development
OSC	-	On-scene Coordinator (Superfund Removals)
OSHA	-	Occupational Safety and Health Administration
OSW	-	Office of Solid Waste
OSWER	-	Office of Solid Waste and Emergency Response
OWPE	-	Office of Waste Programs Enforcement
PA	-	Preliminary Assessment
PCMD	-	Procurement and Contracts Management Division
PCS	-	Program Control System
PEB	-	Performance Evaluation Board
PIRS	-	Pollution Incident Reporting System

PO	-	Project Officer (HQ)
POLREP	-	Pollution Report
PR	-	Planned Removal
PR	-	Procurement Request/Purchase Requisition
PRP	-	Potentially Responsible Party
PSPM	-	Priority Site Planning Module
PSSM	-	Priority Site Summary Module
PTS	-	Project Tracking System
QA/QC	-	Quality Assurance/Quality Control
RA	-	Regional Administrator
RA	-	Remedial Action
RAB	-	Remedial Action Branch, OERR
RAMP	-	Remedial Action Master Plan (no longer prepared)
RAP	-	Remedial Accomplishments Plan
RAS	-	Routine Analytical Services
RC	-	Remedial Construction = Remedial Action
RCRA	-	Resource Conservation Recovery Act of 1976
RD	-	Remedial Design
REAP	-	Regional Enforcement Accomplishments Plan
REC	-	Regional Enforcement Counsel
REM/FIT	-	Remedial Planning/Field Investigation Team
RFITO	-	Regional Field Investigation Team Office
RFP	-	Request for Proposals
RFMO	-	Regional Financial Management Officer
RI	-	Remedial Investigation
RI/FS	-	Remedial Investigation/Feasibility Study
RMIS	-	Resource Management Information System
ROD	-	Record of Decision
ROP	-	Regional Operating Plan
RP	-	Responsibility Party
RPM	-	Regional Project Manager
RPO	-	Regional Project Officer
RQS	-	Reportable Quantities
RRC	-	Regional Response Center
RRT	-	Regional Response Team

RS	-	Responsiveness Summary
RSCC	-	Regional Sample Control Center
RSCRC	-	Regional Superfund Community Relations Coordinator
RSPO	-	Remedial Site Project Officer
RTS	-	Removal Tracking System
SAS	-	Special Analytical Services
SBA	-	Small Business Administration
SBE	-	Small Business Enterprises
SCAP	-	Superfund Comprehensive Accomplishments Plan
SCP	-	State Contingency Plan
SCRC	-	State Community Relations Coordinator
SDWA	-	Safe Drinking Water Act
SF	-	Standard Form
SKIM	-	Spill Clean-Up Inventory System
SMO	-	Sample Management Office
SMP	-	Site Management Plan
SOW	-	Statement of Work
SPCC	-	Spill Prevention Control & Countermeasure System
SPMS	-	Strategic Planning and Management System
SPO	-	State Project Coordinator Branch, OERR
SRMS	-	Site Response Management System
SSC	-	State Superfund Contract
STORET	-	Water Quality Storage & Retrieval System
STS	-	Site Tracking System
TAT	-	Technical Assistance Team
TDB	-	Toxicological Data Base
TDD	-	Technical Directive Document
TAWS	-	Technical Enforcement Services
TSCA	-	Toxic Substances Control Act
TSD	-	Treatment, Storage, and Disposal Facility
USCG	-	United States Coast Guard
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey
WA	-	Work Assignment
WBE	-	Women's Business Enterprise

ZM	-	Zone Manager
ZPM	-	Zone Project Manager
ZPMO	-	Zone Project Management Office

APPENDIX F

SITE SPECIFIC SAFETY PLAN

APPENDIX F

SITE SPECIFIC SAFETY PLAN

Master Metals Inc., Site

Cleveland, Ohio

I. GENERAL INFORMATION

A. Project Name:	Master Metals Inc., Site	
B. Location:	2850 W. Third Street, Cleveland, Ohio	
C. Project Number:	639	
D. Client:	Master Metals	Inc.

II. PROJECT ORGANIZATION

A. Project Coordinator:	Dean Pisani
B. Field Project Manager:	Rob Santoro and Erich Kissick
C. Site Health & Safety Officer:	Don Self
D. Information\Data Coordinator:	Shane Banks
E. Technical\Engineering Support:	Michael DeRosa

III. SITE SAFETY PLAN PREPARATION

A. Prepared by:	Shane Banks
B. Reviewed by:	Don Self and Michael DeRosa

IV. SITE HISTORY AND DESCRIPTION

A. Type of Site:

The total area of the site is 4.3 acres. The **Master Metals** facility is located the "flats" area

of downtown Cleveland in a heavy industrial area. Due to elevated levels of lead contained in surrounding materials, time-critical removal activities will be undertaken. The Cuyahoga River is located approximately 1,500 feet to the east of the site. The nearest residential area is approximately 0.5 miles to the northwest.

B. Site Description:

The site is an out of service secondary lead smeltering facility which produced lead alloys from lead-bearing dross and lead scrap materials. Operations began in 1932 and ceased operations in 1993. The site contains numerous large structures and several smaller ones. The area is primarily covered with concrete with approximately 0.5 acres being vegetated.

C. Unusual Site Features or Physical Hazards:

Deteriorating structures, various waste debris and other objects, rodents and possible temperature extremes.

D. Waste Type: Solid and liquid

E. Hazardous Materials (known or suspected): Lead contaminated material, TPHs and BTEX (fuel and waste oil).

F. Toxicity: PEL- Fifty micrograms of lead per cubic meter of air averaged over a 8 hour work day (as stated in 29 CRF Part 1910.1025).

G. Physical Hazards:

Excavation equipment, demolition operations, material transport.

H. Weather:

On-site work tasks are expected to commence during late spring and continue through late summer. Temperatures expected to be 60 - 90 f.. Periodic rain storms are expected with high humidity.

V. SITE ORGANIZATION AND CONTROL

A. Work areas identified: Secured

B. Decontamination areas: A central decontamination unit will be established.

C. Support area established: A central administrative office will be established.

D. Site security: 24 hour controlled access

E. Entry and escape routes: To be identified during initial safety meeting

F. Sketch of site attached: Yes

VI. JOB ACTIVITIES IN WORK PLAN

Type of activities planned:

Activities will include sampling of materials, materials excavation, loading and transport of waste material, demolition of existing structures, and decontamination. Other tasks performed will include sampling soils during different phases of removal activities.

VII. EDUCATION AND TRAINING

A. Site specific training: 29 CFR 1910.120 (e)

B. Type of training: 40 hour classroom and hands-on training with EPA accreditation

VIII. MEDICAL SURVEILLANCE

A. Medical monitoring:

Blood test for Heavy Metals (lead, cadmium, chrome and mercury) will be performed on associates before and after Site work. A physical including pulmonary function test, chest X-ray, physical, and drug test are performed annually on all ENTACT associates.

IX. AMBIENT AIR MONITORING

A. Specific requirements:

Ambient air monitoring will be performed at four (4) different locations while Corrective action activities are in progress. Daily personnel monitoring will be performed during excavation, subsurface containment system and cap installation procedures.

B. Equipment requirements:

Furnished by independent industrial hygiene firm

X. PERSONNEL PROTECTION REQUIREMENTS

A. Job Activity: Site Mobilization and Preparation performed in Level C:
Full-face or half-face respirators with HEPA cartridges, hard hats, safety glasses, steel-toed boots, gloves, and tyvek suits.

B. Job Activity: Excavation and Loading and transport of Contaminated Material will be performed in Level C:
Full-face or half-face respirators with HEPA cartridges, hard hats, safety glasses, steel-toed boots, gloves, and tyvek suits.

C. Job Activity: Waste Characterization of unknown materials and debris may be performed in Level A:
Fully-encapsulating, chemical resistant suit, inner chemical resistant gloves, outer chemically resistant gloves, chemical resistant safety boots, pressure-demand, full-face supplied air breathing apparatus (SABA), SABA cascade system air supply assembly with regulators, and 200' of chemical resistant air supply hose and escape pack SCBA, two-way radio

communication.

D. Job Activity: Decontamination of on site debris and waste material in Level C: Full-face or half-face respirators with HEPA cartridges, hard hats, safety glasses, steel-toed boots, water resistant gloves, and saranex suits.

E. Job Activity: Demolition activities will be performed in Level C: Full-face or half-face respirators with HEPA cartridges, hard hats, safety glasses, steel-toed boots, gloves, and tyvek suits.

XI. SAFETY EQUIPMENT LIST

A. First aid: Portable first aid kits positioned in work areas and in central decontamination unit.

B. Fire protection: ABC type fire extinguisher

C. Communications: Danger signs, barricade tape, 2-way radio communication at all times between all responsible parties on-site.

D. PPE: Respiratory protection as required by federal regulations during all work activities. Tyvek suits, hard hats, steel-toed boots, and safety glasses to be used during regular work activities.

E. Decon. Equip.: All decontamination procedures to follow guidelines set forth by the EPA and federal regulations. A complete decontamination area will be set up on-site.

F. Sanitation: Latrines and handwash stations will be located on-site.

G. PPE Disposal: PPE will be sampled and stored for disposal.

XII. DECONTAMINATION PROCEDURES

A. Work activities:

Site Removal Activities will be performed in Level C PPE as determined by air monitoring indications. Water and body soap will be used for decontamination.

Waste Characterization of unknown material may be conducted in Level A PPE and a contingency plan will be established for decontamination procedures in this instance.

B. ENTACT will establish a primary decontamination area at a location to be determined upon arrival. A remote decontamination area will also be established inside the Work Zone containment area. The purpose of the remote decontamination unit is to provide the associates with a changing area when exiting the work area.

C. As ENTACT begins Removal Activities we will provide associates with hygiene facilities to be used to decontaminate exposed workers, equipment, and clothing before such associates leave the work area. These decontamination areas will consist of the following:

- A clean change area
- An equipment area

The clean change area will be a space in which associates will remove don their respirators and disposable clothing. The equipment area will be a space where workers will remove their protective coveralls and where equipment that is to be used in the work area can be stored.

ENTACT will ensure that associates:

1. Enter the decontamination area.
2. Remove and deposit street clothes within a locker.
3. Put on protective clothing and respiratory protection before leaving the clean change area.
4. Before entering the enclosure, the associates shall pass through the equipment area.

ENTACT shall ensure the following decontamination area exit procedures:

1. Before leaving the containment area, associates shall remove all loose contaminated

debris from their protective clothing.

2. Associates shall remove their protective clothing in the equipment area and deposit the clothing in a waste container.

XIII. CONTINGENCY PLANS

A. Local sources of assistance:

Local police, hospital, fire, and emergency medical phone numbers will be positioned in the decontamination and job trailers (Appendix B and C).

B. Ambulance, Fire, and Police: 911

C. Site phone number: to be determined

D. National or regional sources of assistance:

1.	ENTACT	1-214-580-1323
2.	Ohio EPA	1-614-644-2917
3.	Chemtrec (24 hour)	1-800-424-9300
4.	Bureau of Explosives	1-202-293-4048
5.	Communicative Disease Center	1-404-633-5313
6.	National Response Center	1-800-424-3802
7.	DOT Office of Hazardous Operations	1-202-426-0656
8.	US Coast Guard	1-800-424-8802
9.	National Agriculture Chemical Assoc.	1-513-961-4300

E. Evacuation Procedures:

To be posted for Corrective Action Activities of the project. Associates will be instructed prior to start up of each phase of work. Also, escape or exit routes from the Work Zone and trailers will be clearly marked in each phase.

F. Hospital: Grace Hospital

2307 W.1 :h St.

Cleveland, Ohio 44113

(216) 687-1500

XIV. This site specific Health and Safety Plan is based on information available at the time of preparation. Unexpected conditions may arise. It is important that personal protective measures be thoroughly assessed prior to and during the planned activities. Unplanned activities and/or changes in the hazard status should initiate a review of major changes in this plan.

Changes in field activities or hazards: _____

_____

_____

_____

Proposed Amendments: _____

_____

_____

_____

Site Safety Plan Written by: _____

Site Safety Plan Accepted by: _____

Site Safety Plan Approved by: _____

OCCUPATIONAL STANDARDS AND EXPOSURE GUIDELINES FOR CHEMICAL SUBSTANCES OF CONCERN

CAS No.	Substance	OSHA PEL	ACGIH TLV	NIOSH REL Level
7740-38-2	Arsenic and Compounds	10 ug/M^3 [4]	200 ug/M^3 (200 ug/M^3)	CA [2]
		8-HR [3] TWA		
7439-92-1	Lead, Inorganic Fumes and Dust	50 ug/M^3	150 ug/M^3	Variable
	(as Pb)	8-HR TWA	TLV - TWA	
7440-43-9	Cadmium Dust	200 ug/M^3	50 ug/M^3	CA
		8-HR TWA	TLV - TWA	
1314-13-2	Zinc Oxide	5000 ug/ M^3 (fume)	10,000 ug/M^3	NA [5]
		8-HR TWA Respirable fraction	TLV - TWA Dust	
7440-50-8	Copper Dust	1,000 ug/M^3	1,000 ug/M^3	NA
		8-HR TWA	TLV - TWA	

Notes:
(1) ug/M^3 = micrograms per cubic meter
(2) CA = Carcinogen
(3) HR = Hour
(4) TWA = Time Weighted Average
(5) NA = Not Acceptable

CHEMICAL HAZARD INFORMATION FOR POTENTIAL U.S.S. LEAD SITE CONTAMINANTS

Contaminant (Synonym)	OSHA PEL/ ACGIH TLV	IDLH	Physical/ Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Antimony V	0.5 mg/m^3	80 mg/m^3	Silvery-white, hard, brittle solid VP: None LEL: None UEL: None FL. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Dizziness, vomiting, diarrhea, nausea, muscle cramps, dermatitis, cardiac arrest.
Arsenic	0.01 mg/m^3	Carcinogen[1]	Whitish-gray, brittle solid with metallic luster. VP: None LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Gastrointestinal pain, dermatitis, hyperpigment of skin, respiratory irritation.
Cadmium	0.2 mg/m^3	Carcinogen[1]	White, malleable, ductile solid with metallic luster. VP: None LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Pulmonary edema, chills, muscle aches, diarrhea, irritation of eyes, nausea, tremor.

Calcium Sulfate (Plaster of Paris)	5mg/m^3	NA	White, chalky powder, hardens into solid when mixed with water and dried. VP: None LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion	Breathe fresh air, drink large quantities of water, get medical help.	Nausea, diarrhea.

CHEMICAL HAZARD INFORMATION FOR POTENTIAL U.S.S. LEAD SITE CONTAMINANTS

Copper	1 mg/m^3	NA	Odorless, solid, heavy, ductile metal. VP: None LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Chills and fever, weakness, headache, muscle aches, lassitude, irritation of eyes, nausea, tremor.
Lead	0.05 mg/m^3	700 mg/m^3	Odorless, solid, heavy, ductile, soft, gray metal. VP: None LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Weakness, lassitude, facial pallor, abdominal pain, anemia, irritation of eyes, tremor.
Mercury	0.05 mg/m^3	28 mg/m^3	Silvery, mobile, odorless liquid. VP: 0.0012 mm LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Weakness, headache, abdominal pain, insomnia, irritation of eyes, stomatitis, tremor.
Zinc	5 mg/m^3	NA	Bluish-white, malleable, ductile solid with metallic luster. VP: None LEL: None UEL: None Fl. Pt.: None	Inhalation Ingestion Skin absorption	Wash eyes/skin immediately, provide artificial respiration, get medical help.	Chills and fever, tight chest, dyspepsia, headache, blurred vision, nausea, vomiting.

KEY:

ACGIH - American Conference of Governmental Industrial Hygienists

IDLH - Immediately Dangerous to Life and Health

OSHA - Occupational Health & Safety Administration

VP - vapor Pressure in millimeters of mercury

mg/m3 - milligrams per cubic meter

Fl. Pt. - Flash point

LEL - Lower Explosive Limit

TLV - Threshold Limit Value

UEL - Upper Explosive Limit

LEAD HEALTH DATA

(QUOTED FROM 29 CFR 1910.1025)

TABLE 5-1

SUMMARY OF OSHA LEAD STANDARD

- **Occupational Lead Exposure**:
  - Lead Metal
  - Lead Dust
  - Lead Fume
- **How Lead Enters the Body**:
  - Inhalation - Breathing dust and fume
  - Ingestion - Swallowing lead particles
  - Skin absorption does not occur except with organic forms of lead
  - Inhaled lead particles may enter blood stream
  - Ingested lead is absorbed in the blood in much the same way as the food we eat
- **Lead Effects**:

  If lead is accumulated by the body faster than it can be eliminated , the following symptoms may occur:

  - Constipation or diarrhea
  - Lack of appetite
  - Weight loss
  - Nausea
  - Abdominal pain
  - Lead poisoning symptoms:
  - Muscle aches
  - Joint tenderness
  - Anemia
- **Permissible Exposure Limit (PEL)**:
  - Maximum airborne level of lead to which employee may be exposed over a full shift
  - 50 micrograms per cubic meter of air averaged over an 8-hour period
- **Action Level (AL)**:
  - Worker exposure to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period

LEAD HEALTH HAZARD DATA

A. WAYS IN WHICH LEAD ENTERS YOUR BODY

When absorbed into your body in certain doses, lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect to you not only from the immediate toxic effect of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as dust, fume, or mist it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and swallowed. If you handle food, cigarettes, chewing tobacco, or makeup which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to organs and whole body systems.

B. EFFECTS OF OVER EXPOSURE TO LEAD

Short - term (Acute) Overexposure

Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic

effects which take longer to acquire. Lead adversely affects numerous body systems after periods of exposure as short as days or as long as several years.

Long - term (Chronic) Overexposure

Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness. fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain.

Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents of whom either one was exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

Overexposure to lead also disrupts the blood-forming systems resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigue as a result of decreased oxygen-carrying capacity in the blood. The levels of lead anticipated in the removal activities are not expected to be near the levels which cause the preceding condition.

ARSENIC HEALTH DATA

(Quoted from 29 CFR 1910.1018)

ARSENIC HEALTH DATA

A. COMMENTS

The health hazards of inorganic is high.

B. WAYS IN WHICH THE CHEMICAL AFFECTS YOUR BODY

Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic may also affect your body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. Because inorganic arsenic is a poison, you should wash your hands thoroughly prior to eating or smoking.

NONCARCINOGENIC EFFECTS

The OSHA standard is based on minimizing risk of exposed workers dying of lung cancer from exposure to inorganic arsenic. It will also minimize skin cancer from such exposures.

The following three sections quoted from "Occupational Diseases: A Guide to Their Recognition," Revised Edition, June 1977, released by the National Institute for Occupational Safety and Health is included to provide information on the nonneoplastic effects of exposure to inorganic arsenic. Such effects should not occur if the OSHA standards are followed.

A. LOCAL

Trivalent arsenic compounds are corrosive to the skin. Brief contact has no effect but prolonged contact results in a local hyperemia and later vesicular or pustular eruption. The moist mucous membranes are most sensitive to the irritant action. Conjunctiva, moist and macerated areas of skin, the eyelids, the angles of the ears, nose, mouth, and respiratory mucosa are also vulnerable to the irritant effects. The wrists are common sites of dermatitis, as are the genitalia if personal hygiene is poor. Perforations of the nasal septum may occur. Arsenic trioxide and pentoxide are capable of producing skin sensitization and contact dermatitis. Arsenic is also capable of producing keratoses, especially of the palms and soles.

B. SYSTEMIC

The acute toxic affects of arsenic are generally seen following ingestion of inorganic arsenic compounds. This rarely occurs in an industrial setting. Symptoms develop within 1/2 to 4 hours following ingestion and are usually characterized by constriction of the throat followed by dysphagia, epigastric pain, vomiting, and watery diarrhea. Blood may appear in vomitus and in stool. If the amount ingested is sufficiently high, shock may develop due to severe fluid loss, and death may ensue in 24 hours. If the acute effects are survived, exfoliative dermatitis and peripheral neuritis may develop.

Cases of acute arsenical poisoning due to inhalation are exceedingly rare in industry. When it does occur, respiratory tract symptoms -- cough, chest pain, dyspnea -- giddiness, headache and extreme general weakness precede gastrointestinal symptoms. The acute toxic symptoms of trivalent arsenical poisoning are due to severe inflammation of the mucous membranes and greatly increased permeability of the blood capillaries.

Chronic arsenical poisoning due to ingestion is rare and generally confined to patients taking prescribed medications. However, it can be a concomitant of inhaled inorganic arsenic from swallowed sputum and improper eating habits. Symptoms are weight loss, nausea and diarrhea alternating with constipation, pigmentation and eruption of the skin, loss of hair, and peripheral neuritis. Chronic hepatitis and cirrhosis have been described. Polyneuritis may be the salient feature, but more frequently there are numbness and paralysis of "glove and stocking" distribution. The skin lesions are usually melanotic and keratotic and may occasionally take the form of an intradermal cancer of the squamous cell type, but without infiltrative properties. Horizontal white lines (striations) on the fingernails and toenails are commonly seen in chronic arsenical poisoning and are considered to be a diagnostic accompaniment of arsenical polyneuritis.

Inhalation of inorganic arsenic compounds is the most common cause of chronic poisoning in the industrial situation. This condition is divided into three phases based on signs and symptoms.

First Phase: The worker complains of weakness, loss of appetite, some nausea, occasional vomiting, a sense of heaviness in the stomach, and some diarrhea.

Second Phase: The worker complains of conjunctivitis, a catarrhal state of the mucous membranes of

the nose, larynx, and respiratory passage. Coryza, hoarseness, and mild tracheobronchitis may occur. Perforation of the nasal septum is common, and is probably the most typical lesion of the upper respiratory tract in occupational exposure to arsenical dust. Skin lesions, eczematoid and allergic in type, are common.

Third Phase: The worker complains of symptoms of peripheral neuritis, initially of hands and feet, which is essentially sensory. In more severe cases, motor paralyses occur: the first muscles affected are usually the toe extensors and the peronei. In only the most severe cases will paralysis of flexor muscles of the feet or of the extensor muscles of hands occur.

Liver damage from chronic arsenical poisoning is still debated, and as yet the question is unanswered. In cases of chronic and acute arsenical poisoning, toxic effects to the myocardium have been reported based on EKG changes. These findings, however, are now largely discounted and the EKG changes are ascribed to electrolyte disturbances concomitant with arsenicalism. Inhalation of arsenic trioxide and other inorganic arsenical dusts does not give rise to radiological evidence or pneumoconiosis. Arsenic does have a depressant effect upon the bone marrow, with the disturbances of both erythropoiesis and myelopoiesis.

CONFIDENTIAL INFORMATION OF ENTACT

Entact uses proprietary technology in additive and treatment processing to achieve its fixation and permeability results. Patents have either been issued or are pending.